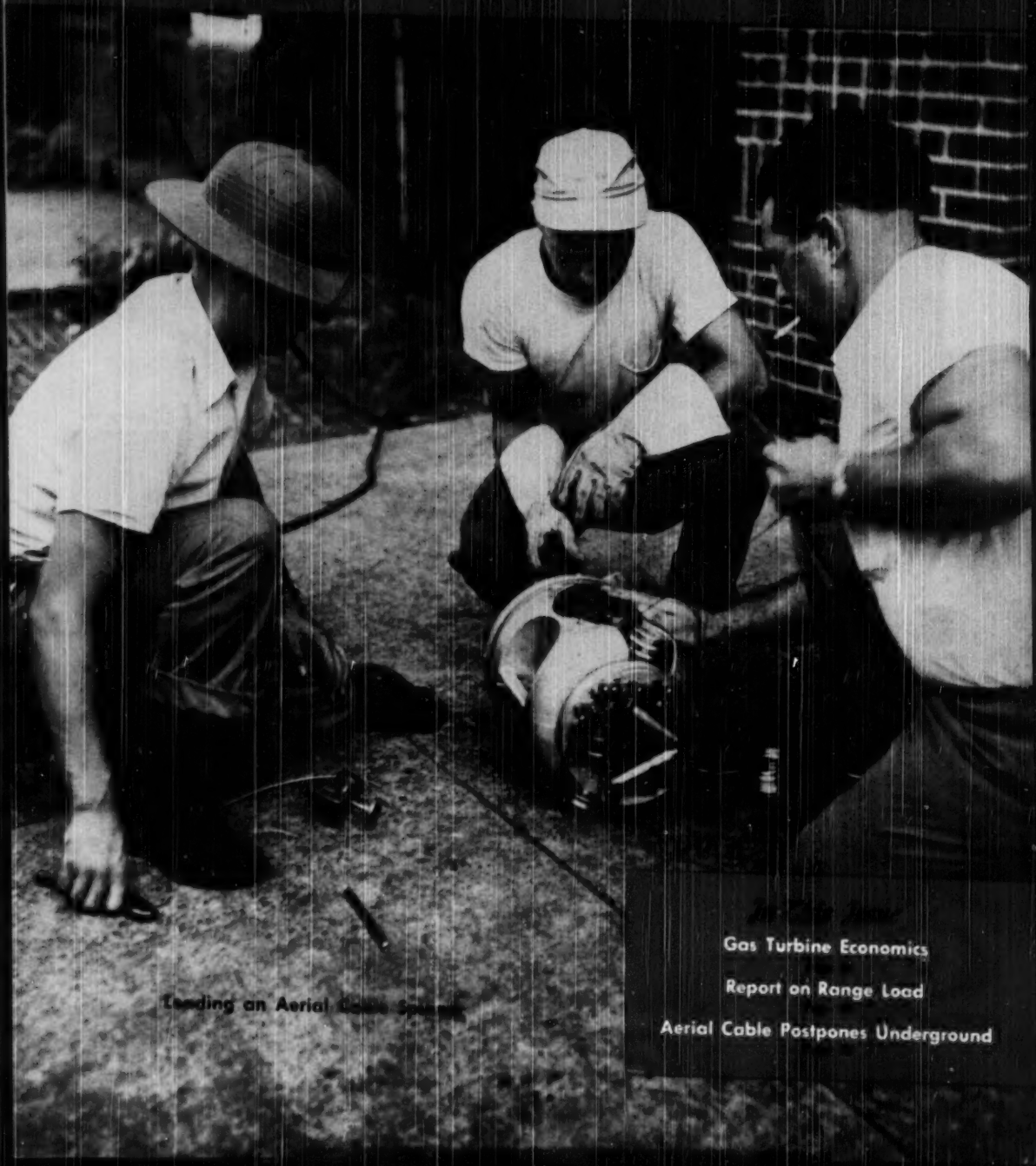
ELECTRICAL WORLD

A McGRAW-HILL PUBLICATION



Gas Turbine Economics

Report on Range Load

Aerial Cable Postpones Underground

KEEP TURBINE SYSTEMS CLEAN

Photo courtesy Elliott Company, Inc.

Avoid dangerous rust, sludge and foam by using TEXACO REGAL OILS (R&O)

No matter how hard you "push" your turbines to meet load demands, you always have an extra margin of safety in *Texaco Regal Oils (R & O)*. They keep turbine lubricating systems clean . . . free of rust, sludge and foam . . . assuring normal bearing temperatures and instantly responsive governors.

The reasons why, start with the fine base stocks from which *Texaco Regal Oils (R & O)* are made. These are refined by special Texaco methods, fortified with powerful rust and oxidation inhibitors, then further processed to prevent foaming.

The result is turbine oil of truly outstanding quality. Use *Texaco Regal Oils (R & O)* to assure extra protection for your turbines . . . and gain an extra economy from their extra-long service life. They meet the stringent requirements of all leading turbine builders.

Let a Texaco Lubrication Engineer help you increase efficiency through effective, cost-saving lubrication. Just call the nearest of the more than 2,000 Texaco Wholesale Distributing Plants in the 48 States, or write:

☆ ☆ ☆

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO Regal Oils (R&O)

FOR ALL TURBINES

OF PERSONAL INTEREST

Electrical World's second Annual Forecast issue will be published Sept. 11. With the help of industry leaders and the McGraw-Hill Dept of Economics, our editors forecast the status of the industry for the coming year.

In this year's forecast, the editors also check up on themselves by taking a good hard look at last year's crystal gazing. They find it surprisingly good. After last year's forecast, many experts told us we were far too optimistic. But it turned out that the only places in which we erred (and not much at that) were in the understatements.

We're not revealing any statistics about the forecast coming Sept. 11, but we can say that **E.W.'s** editors feel that the present high level of industrial production will be increased. And although many men have said that the industry's expansion program would taper off during the coming year, it now appears that the program's tempo will be stepped up.

We think you'll find this issue of particular value and interest. It's coming Sept. 11.

INCREMENTOMETER

Joseph Levitt, a personable young man from Pratt Institute, dropped in the other day to talk about his Incrementometer.

This machine automatically determines optimum loading for each station in a generation system, for any total system load, once input-output curves for each station have been established. It's in **Electrical World** for Aug. 28.

ELECTRICITY ON THE FARM

Opportunities for electricity to make life easier and incomes fatter for farmers are still being discovered almost every day.

Reclaiming of wasteland, through pumping water from swamps, is one way. Storing fresh fruits in cold storage on the farm until prices hit peaks is another.

Fact is that opportunities to make more money on the farm through using electricity are limited only by the farmer's own resourcefulness.

Consumers Power Co of Michigan has completed a conscientious and highly interesting study of farm use of electric power. They discuss many applications and show how they work to advantage—not only to the farmers —but as a great field of utility load building.

You'll see it in **Electrical World** for Aug. 28.

THE EDITORS

ELECTRICAL WORLD

Published for 76 years for those engaged in the business of generating, transmitting, distributing or applying electric power

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ELECTRICAL WORLD, Published weekly by McGraw-Hill Publishing Company, Inc. Publication Office, 99-129 North Broadway, Albany 1, N. Y. Editorial and Executives Offices, 330 West 42nd St., New York 18, N. Y. James H McGraw (1860-1948), Founder; Curtis W McGraw, President; Willard Chevalier, Executive Vice President; Joseph A Gerardi, Vice President and Treasurer; John J Cooke, Secretary; Paul Montgomery, Senior Vice President, Publications Division; Ralph B Smith, Editorial Director; Nelson Bond, Vice President and Director of Advertising; J E Blackburn, Jr, Vice President and Director of Circulation. Subscription rates: Single copy 35 cents. In the United States, $6 a year, $9 for two years, $12 for three years. Canada, $7 for one year, $11 for two years, $14 for three years. (Canadian money, at par.) Pan-American countries, $15 for one year, $25 for two years, $30 for three years. All other countries $20 for one year, $30 for two years, $40 for three years. Entered as second-class matter, November 16, 1936, at the Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

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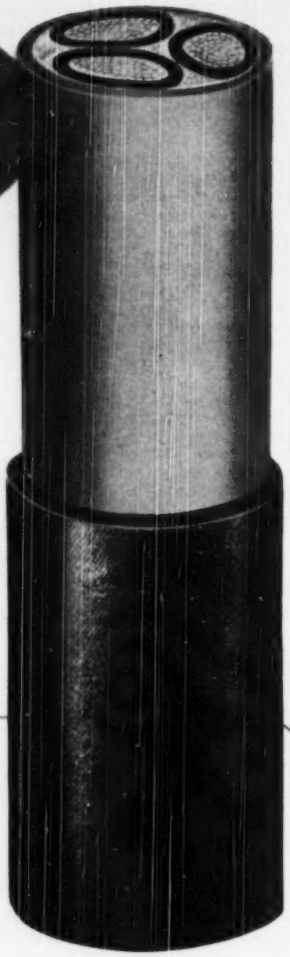
AFTER 16 YEARS LEAD-SHEATHED POWER CABLE STILL SHOWS NO CORROSION

WITH OKOSHEATH PROTECTIVE COVERING



Over 16 years ago, in a duct line known to be highly corrosive to ordinary lead cable sheathing, a 150-foot test section of Okonite-Callender paper insulated cable with Okosheath Protective Covering was installed by a major utility. At the same time, a similar cable, protected with ordinary covering, was installed under identical conditions.

Periodic inspections were made of both cables. After 4 years the cable with the usual covering was eliminated from the test, due to excessive deterioration. Yet 12 years later, in November, 1949, when the cable with the Okosheath Protective Covering was last inspected, the lead sheath showed no signs of corrosion whatsoever!

This cable showed but little deterioration of the outer covering in spite of the abnormal abrasion caused by continued pulling in and out of the ducts for periodic examination. With the lead sheath untouched by corrosion this cable can be expected to deliver many more years of service.

OTHER INSTALLATIONS SHOW SIMILAR RESULTS

24,000 feet of Okosheath Protective Covered 138 KV oil-filled cable were installed in a severely corrosive salt marsh in 1937. Cable covering was as good as new when inspected after 11 years of service.

In another installation in the South, cable with Okosheath Protective Covering was still operating successfully after 10 years, whereas a cable with unprotected lead sheath failed in 7 years. Bulletin EW-1047 gives technical data on Okometal-Okosheath. Write us today for a copy. The Okonite Company, Passaic, N. J.

. . AND TODAY'S IMPROVED COMPOSITE SHEATH WITH OKOSHEATH AND OKOMETAL IS EVEN BETTER

Continuous improvement in the neoprene-compounded protective covering, applied by Okonite's strip process, plus newly-developed lead alloy sheath makes Okonite-Callender cables even longer-lived.

The illustrations below show the structural superiority of Okometal plus Okosheath Protective Covering. This dual sheath consists of a tough, reinforced Okosheath Protective Covering bonded to an Okometal sheath of reduced thickness and possessing greatly increased resistance to bending fatigue. The combination of these two provides 6 major advantages, available in no other cable: *double the life expectancy, elimination of corrosion, reduced installation and maintenance costs, greater bursting strength, no scoring of lead, and easier pulling.*

BARE LEAD SHEATH
Standard AEIC Thickness
(120 mils)

EQUIVALENT COMPOSITE SHEATH
OKOMETAL of Reduced Thickness
(80 mils)
plus OKOSHEATH Protective Covering

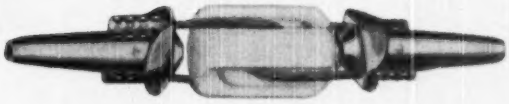
Okonite-Callender cables with this composite sheath meet all AEIC Test requirements for paper cables with plain lead of standard thickness.

8502

OKONITE-CALLENDER

Electroline Automatic Insulating Line Splice SECTIONALIZERS

2200 AND
2300 SERIES



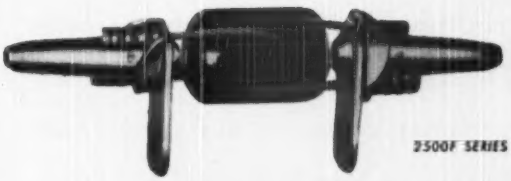
2500 SERIES

These Automatic Insulating Line Splice Sectionalizers offer a large number of line applications —at the lowest possible cost. You'll find these Electroline Sectionalizers ideal for

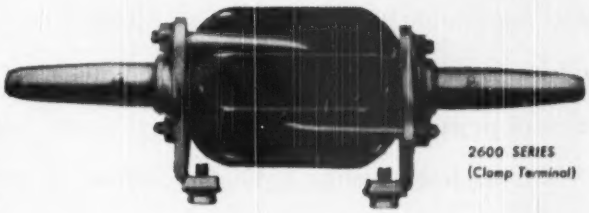
- **REGULATING SECONDARY VOLTAGES**
  Facilitates secondary voltage regulation when used to bank transformer secondaries.
- **FUSING TRANSFORMERS**
  Gives transformers real protection when used to fuse transformer leads.
- **SECTIONALIZING NETWORKS**
  Suitable for sectionalizing networks to isolate the area in trouble.
- **SERIES STREET LIGHTING**
  Simplifies cutting-in series street lamps—merely cut the line and insert conductor ends into sectionalizer.

The mechanical strength of these assemblies exceeds in all cases the rated breaking strength of the conductor size for which they are adapted.

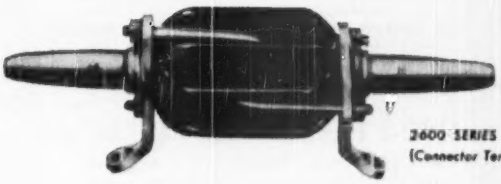
The wet process porcelain insulators used in the 2500 and 2600 series sectionalizers can, if desired, be furnished with a white glaze to reflect the beam of the lineman's searchlight when locating trouble at night.



2500F SERIES



2600 SERIES
(Clamp Terminal)



2600 SERIES
(Connector Terminal)

Send for New Bulletin

Electroline Company

4121 South La Salle Street • Chicago 9, Illinois • IN CANADA—POWERLITE DEVICES, LTD., TORONTO

2,000,000 KVA CAPACITY... WITH

a fuse engineering "FIRST"

Six 115,000-volt SMD-2 Power Fuses, connected two-in-series on each phase, provide 2,000,000 kva three phase symmetrical interrupting capacity at this recently built substation in New York State. This is the first application of fuses for system short circuit protection on such high concentration of power.

The six fuses, costing $3510.00, demonstrate the possible savings over breakers when the latter are not essential to satisfy switching and relaying requirements.

The SMD-2 Fuses pictured here are applied in the primary of a 7500-kva station service transformer directly connected to the 110,000-volt main bus where the available short circuit kva is 1,600,000, symmetrical.

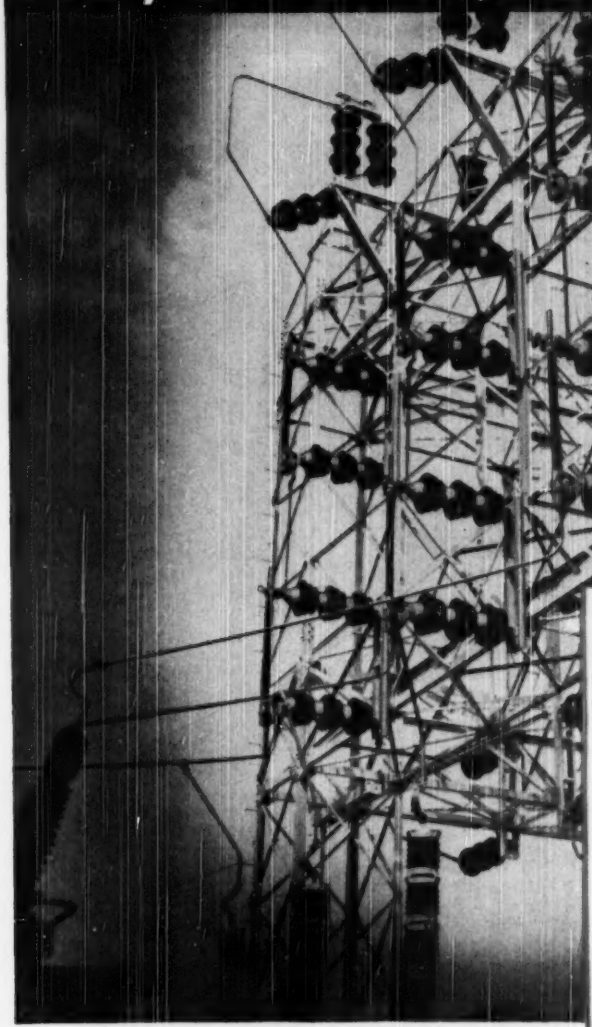
SMD-2 Power Fuses, proved for FULL COVERAGE* protection by several years' service in ratings up to 138,000 volts, are now available down to 34,500 volts.

Your inquiries on similar high interrupting capacity or other possible applications of SMD-2 Power Fuses are invited. New descriptive information is just off the press. Ask for Catalog Section 262.

S&C ELECTRIC COMPANY

Formerly SCHWEITZER & CONRAD, INC.

INTERRUPTING 115,000 VOLT FUSES



* **FULL COVERAGE PROTECTION IS:** the new concept of transformer fusing in which:

A primary fuse is applied for both primary short circuit and secondary back-up short circuit protection. A fuse is expected to perform dependably regardless of type of system; type of fault current; type of application; or system and atmospheric conditions.

* **FULL COVERAGE PROTECTION PROVIDES** — along with the above protection — savings in operating expense by:

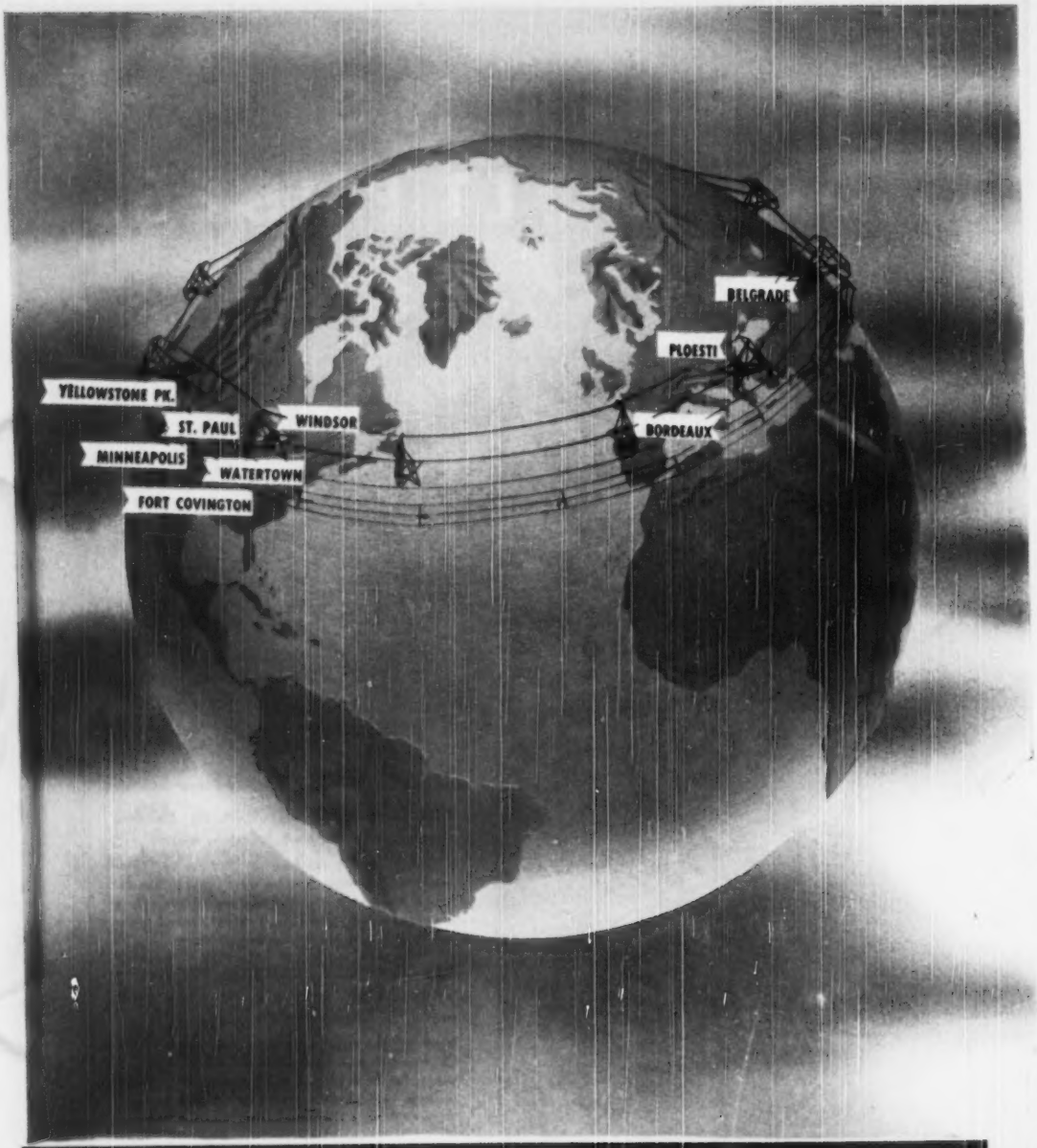
Eliminating the need for replacement of "suspect" fuses on other phases when one fuse blows.
Eliminating the need for periodic replacement of fuses to prevent "sneak-outs" caused by vibration- or age-weakened fusible elements.

* **FULL COVERAGE PROTECTION REQUIRES:**

dependable high and low fault-current interrupting ability;
protection against dielectric breakdown or external flashover from severe recovery voltage;
a fine degree of accuracy in time-current characteristics;
a "non-damageable" fusible element which cannot be injured by surge currents, vibration, or aging;
a choice of time-current characteristics to provide flexibility in coordinating with other primary, and with the secondary, protective devices.

4421 Ravenswood Avenue
Chicago 40, Illinois, U. S. A.

In Canada, Powerlite Devices, Limited, Toronto



ALCOA

FIRST IN ALUMINUM

Enough ACSR to circle the globe 6 times? ...a year's output by Alcoa

It's one of those hard-to-believe facts—but a year's output of ACSR (Aluminum Cable Steel Reinforced) by Alcoa would actually encircle the earth more than six times at the 45th parallel!

Interesting—but what does that mean to you? Just this: that after introducing aluminum electrical conductors in 1898, and making them continuously since, we've learned a lot about conductors and conductor problems. And have accumulated records of that experience.

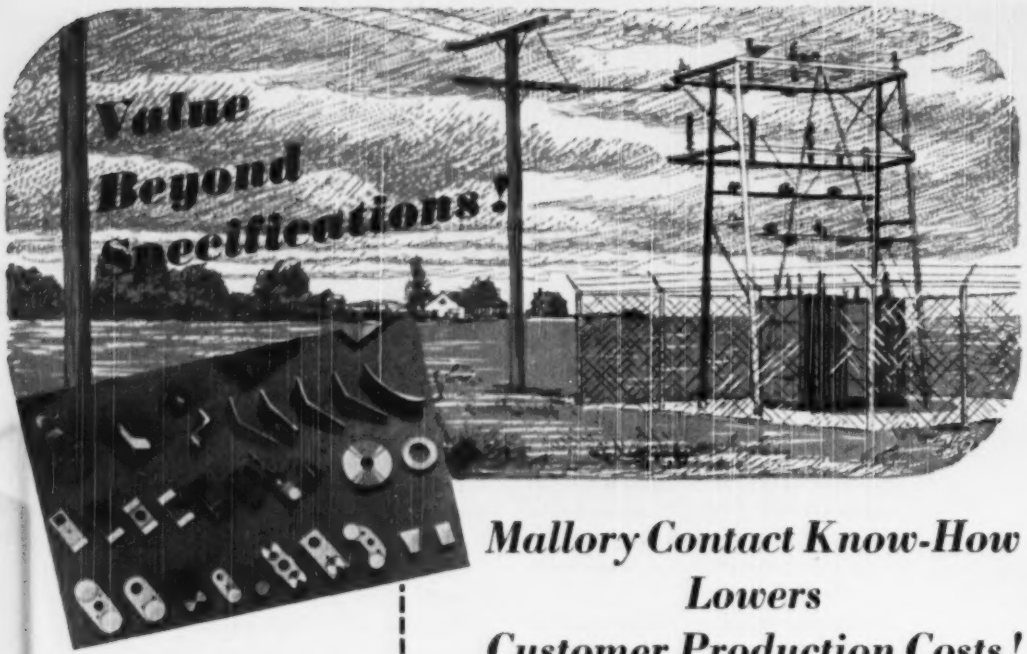
Result: the kind of shirt-sleeve, down-to-earth know-how about the design, manufacture and installation of conductors that helps us serve you better.

ALUMINUM COMPANY OF AMERICA, 1924H Gulf Building, Pittsburgh 19, Pa.

TYPICAL: The combined light weight, strength and endurance of ACSR are dramatically illustrated by this 5,010-foot span of Alcoa ACSR in the Smoky Mountains which has been in service for 32 years—and will be for many more. To make such spans practical, Alcoa engineers have done pioneer work in sag tension calculations, vibration and conductor fatigue problems.

ALCOA ALUMINUM

A·C·S·R



Mallory Contact Know-How Lowers Customer Production Costs!

Elkonite* Contacts

Elkonite is the trade name for a series of contact materials developed by Mallory and manufactured from metal powders. They are best known for their hardness, resistance to mechanical wear and impact, resistance to erosion by arcing, and resistance to sticking.

Elkonite contacts are made by the only method which permits the combining of the desirable features of basic metals which cannot be alloyed. By this means, the high melting points of tungsten, molybdenum, or their carbides, can be combined with the current-carrying ability of silver and copper.

Mallory digs deep for details when a customer presents a new contact application . . . and frequently the search leads to savings far beyond the specific contact problem.

Such was the case with a manufacturer of electric power transmission equipment who was designing a new product. As a by-product of Mallory's study of the contact application, the customer's engineers were able to recommend certain modifications in the basic construction of the equipment. As a result of these findings, the customer completely redesigned his product . . . and production costs were reduced by approximately $100 per unit.

That's value beyond specifications!

Mallory contact know-how is at your disposal. What Mallory has done for others can be done for you!

In Canada, made and sold by Johnson Matthey & Mallory, Ltd., 110 Industry St., Toronto 15, Ontario

Electrical Contacts and Contact Assemblies

*Reg. U. S. Pat. Off.

P. R. MALLORY & CO. Inc.

MALLORY

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

SERVING INDUSTRY WITH

Capacitors	Contacts
Controls	Resistors
Rectifiers	Vibrators
Special Switches	Power Supplies

Resistance Welding Materials

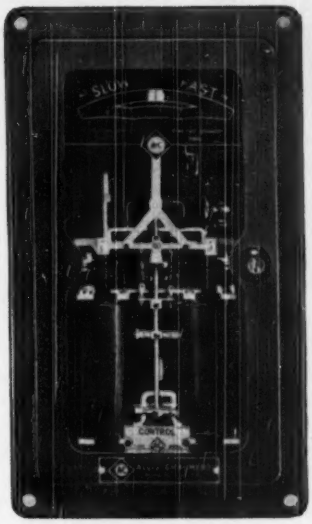
For Smooth, Quick, Absolutely Safe Synchronizing

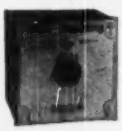
SYNCHRO-OPERATOR
Automatic Synchronizer of AC Machinery

AUTOMATIC SYNCHRONIZATION of synchronous condensers, generators and tie lines, no matter how large, is the job done smoothly, quickly and unerringly by the Synchro-Operator.

Just turn a control switch and the Synchro-Operator takes over. It automatically brings the incoming machine into step with the line and closes the generator breaker at exact synchronism.

The Synchro-Operator is absolutely safe . . . eliminates damage from synchronizing errors . . . indicates relative speed and phase angle . . . anticipates time for circuit breakers to close . . . makes possible synchronizing from a remote point. There are no vacuum tubes — rugged mechanical construction means low maintenance. Only two simple adjustments adapt it to any installation.



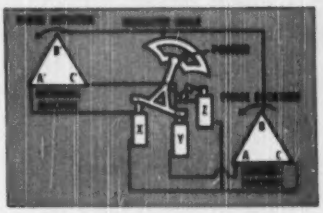


THERE ARE TWO MAIN PARTS

SYNCHRO-OPERATOR — Indicates relative speed and phase angle difference. Phase relation between incoming machine and line is indicated by the pointer behind the slotted dial. Top center indicates synchronism, lower center 180° out. Counter-clockwise rotation of the pointer indicates the incoming machine is slower than the running machine — clockwise rotation that it is faster. The speed at which the pointer travels around the dial indicates relative speed between incoming and running machines. Each time the pointer goes around the dial, a signal is sent to the governor of the incoming machine to raise or lower its speed. Speed of incoming machine is corrected in successive steps until synchronism is reached. Mounts on switchboard, same size as polyphase watthour meter.

AUXILIARY RELAY BOX — contains relays to handle breaker and governor control circuits. Provides protective interlocks. Also contains potentiometer which is adjusted at installation to obtain shortest synchronizing time. Its setting determines the length of time prime mover governor motor runs, and consequently the amount of speed correction, after each corrective signal from the Synchro-Operator.

HOW IT WORKS



The Synchro-Operator contains three solenoids: X, Y, and Z in the above sketch. X and Y are energized by the voltage differential between phases of running and incoming machines and have full voltage applied to them at synchronism. Solenoid Z is energized by the voltage differential between corresponding terminals on running and incoming machines, and has no voltage applied at synchronism.

The plungers of solenoids X and Y are connected through pivots to a floating cross bar that supports the dial pointer and one of the synchronizing contacts. This contact point moves from side to side and up and down, following an elliptical path with the pointer. The other contact point is attached to the plunger of solenoid Z through a dashpot and has a delayed up and down motion. This arrangement permits contacts to close only when phase relationship is correct, and relative speed between machines is low enough to permit breaker closure without damage.

For more information, call your nearby A-C representative or write direct for Bulletin 6386. A-3124

ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

Regulex and Synchro-Operator are Allis-Chalmers trademarks.

Other Allis-Chalmers Control Devices

ROCKING CONTACT REGULATORS — These dependable units are used where features of mechanical type regulators are desired.

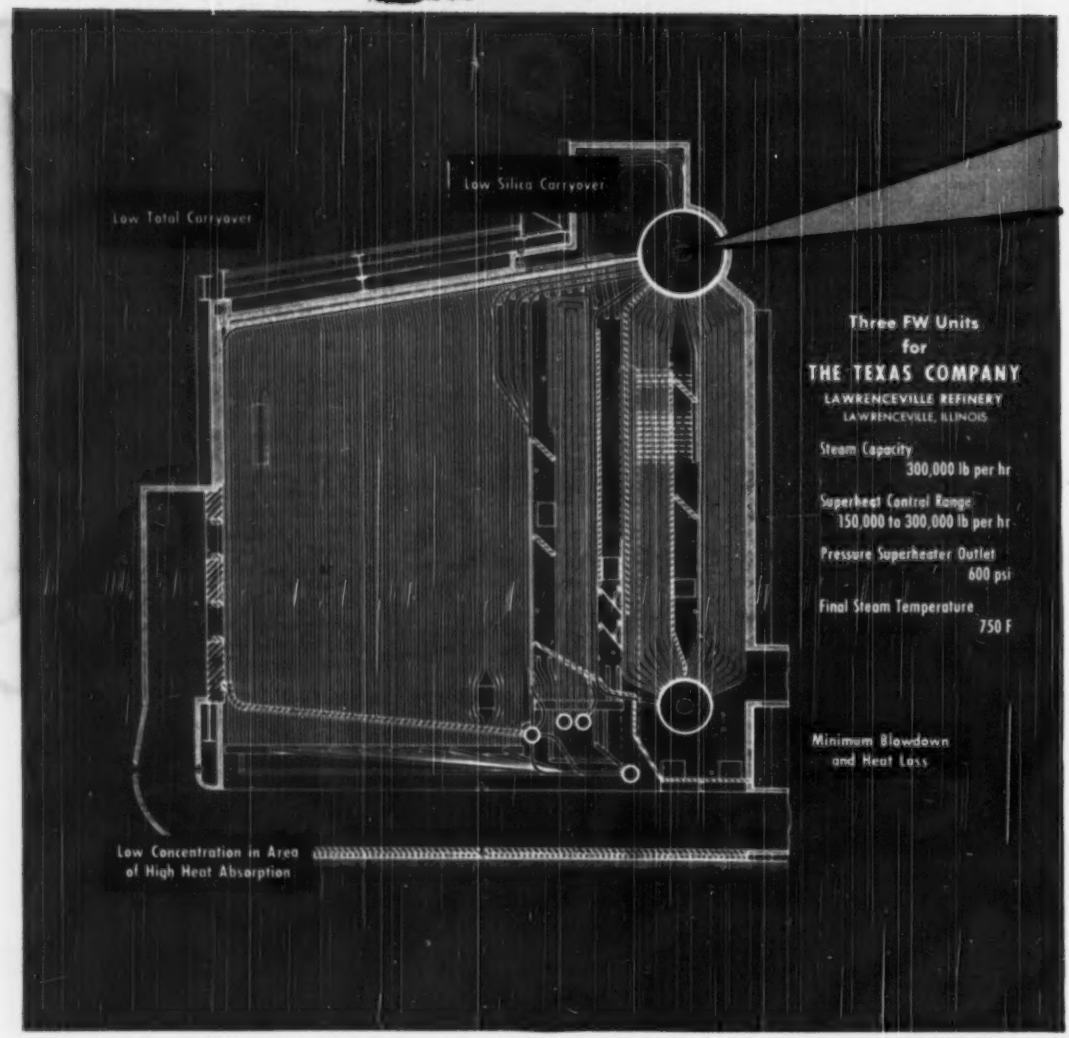
D.C. POSITIONER — Operates from power plant d-c bus, used for remote indication, control, order telegraph, etc.

***REGULEX* CONTROL** — Used where the features of a rotating type regulator are desired.

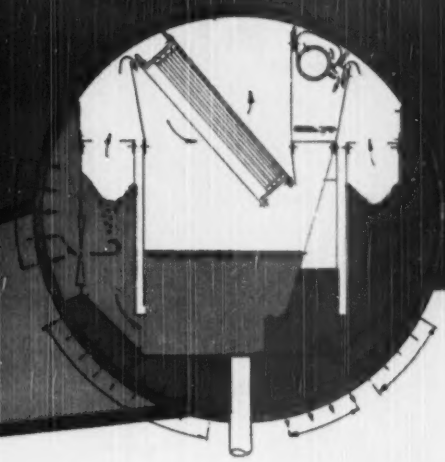
Regulex is an Allis-Chalmers trademark.

high steam purity where it counts

Foster Wheeler Dual Circulation


Low Total Carryover
Low Silica Carryover
Low Concentration in Area of High Heat Absorption
Three FW Units for THE TEXAS COMPANY
LAWRENCEVILLE REFINERY
LAWRENCEVILLE, ILLINOIS
Steam Capacity 300,000 lb per hr
Superheat Control Range 150,000 to 300,000 lb per hr
Pressure Superheater Outlet 600 psi
Final Steam Temperature 750 F
Minimum Blowdown and Heat Loss

Steam Generators



Advantages for Both Central Station and Industrial Use

Under modern operating conditions of high pressure and temperature, the problem of steam purity is of increasing concern to the designers and operators of industrial and central station steam generators. Foster Wheeler engineers have successfully met this challenge by developing the Dual Circulation Steam Generator which already provides materially *higher availability, improved efficiency,* and *lower maintenance of high pressure steam turbines* at one large midwest refinery. Particularly in installations which have high makeup requirements, the Dual Circulation Steam Generator is capable of providing steam of higher purity with less blowdown than is possible in a conventional unit. In units operating on condensate, total solids and especially silica carryover are almost negligible with this design.

Design Features of Dual Circulation Steam Generator

The Foster Wheeler Dual Circulation Steam Generator consists of two separate heat absorbing sections each with its own independent circulating system. The feedwater goes to the primary, high duty, radiant heat absorbing section, which is continuously blown down into the low duty secondary convection section. Most of the steam is generated in the primary section where silica and boiler water concentrations are low. Thus, a marked reduction in the amount of silica carryover in the steam to the prime mover is achieved and tube damage is held at a minimum.

The Texas Company Orders Three Units for Lawrenceville Refinery

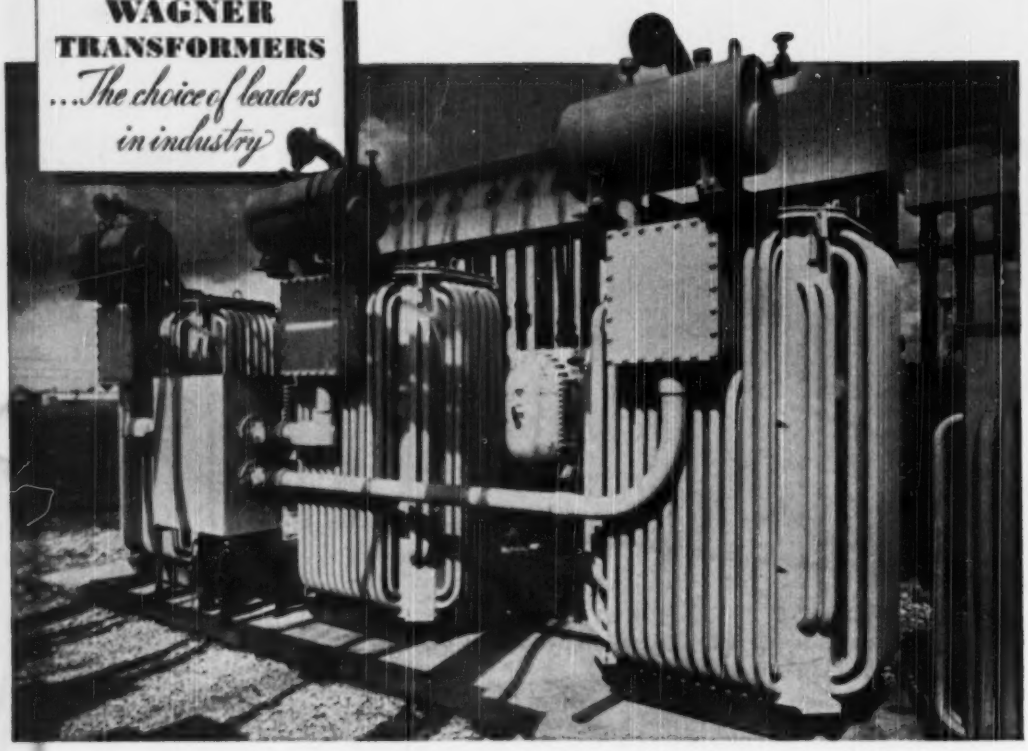
Because of adverse water conditions at the Lawrenceville Refinery, The Texas Company ordered three units, designed for high makeup with high concentration in its makeup. The Lawrenceville project is part of the present construction program in which all crude units are being engineered and constructed by Foster Wheeler.

For further information, write:

FOSTER WHEELER CORPORATION, 165 BROADWAY, NEW YORK 6, NEW YORK

FOSTER WHEELER

WAGNER TRANSFORMERS
...The choice of leaders in industry



Bank of 667 kva, 1 phase, 60 cycle, 2400 to 480 volt Transformers

Wagner Transformers power the production of Rohm & Haas "Chemicals for Industry"

Production of "Chemicals for Industry" by the Rohm and Haas Company, makers of famed Plexiglas, is not a simple one-plant operation. The products of one of their plants may have no resemblance to the commercial products into which they are integrated at another plant. The natural raw material found in Texas, for instance—the processed chemicals manufactured there—and Plexiglas, an end product manufactured in another plant—are all part of a great modern production chain.

Power for production—with Rohm and Haas as with any modern industry—is provided by electricity. The manufacture of chemicals in the Rohm and Haas plant in Deer Park, Texas, is powered by Wagner Transformers and Wagner Motors. Wagner transformers in the main substation take energy at 69,000 volts and feed it to the low voltage substation at 2400 volts. The low voltage substation of Wagner transformers (illustrated above) in turn furnishes 480 volts to motors and to small air-cooled Wagner transformers which furnish 120 volts for lights and other single phase loads.

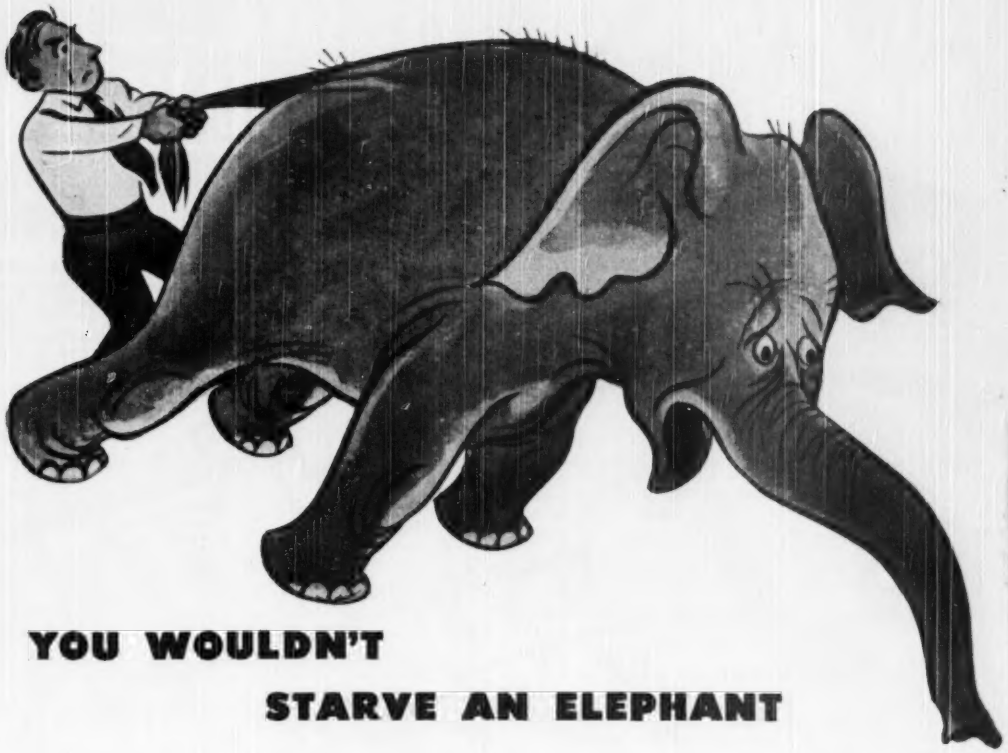
Thirty-one branch offices, located in principal cities, are ready to help you whenever you have a transformer problem. Users of Wagner Transformers also benefit by nationwide service facilities. Write for Bulletin TU-180 and TU-181 for full information on Wagner Power and Distribution Transformers.

WAGNER ELECTRIC CORPORATION
6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

Wagner Electric Corporation
EST. 1891

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 31 PRINCIPAL CITIES



YOU WOULDN'T STARVE AN ELEPHANT

...TO SAVE PEANUTS!

No, and it's just as unsound to risk loss of valuable machinery and production for the sake of saving "peanuts" on initial oil costs. For lubrication is not just "oils and greases" . . . it's also knowledge of machinery, the right lubricants to use, and where and how to use them.

That's why you save so many ways with Socony-Vacuum *Correct Lubrication* . . . a custom-made program of lubrication for your plant that pays off in greater output per machine, less friction loss, lower maintenance costs, and—ultimately—lower lubrication costs.

For the *genuine* savings of Correct Lubrication, call your Socony-Vacuum Representative.

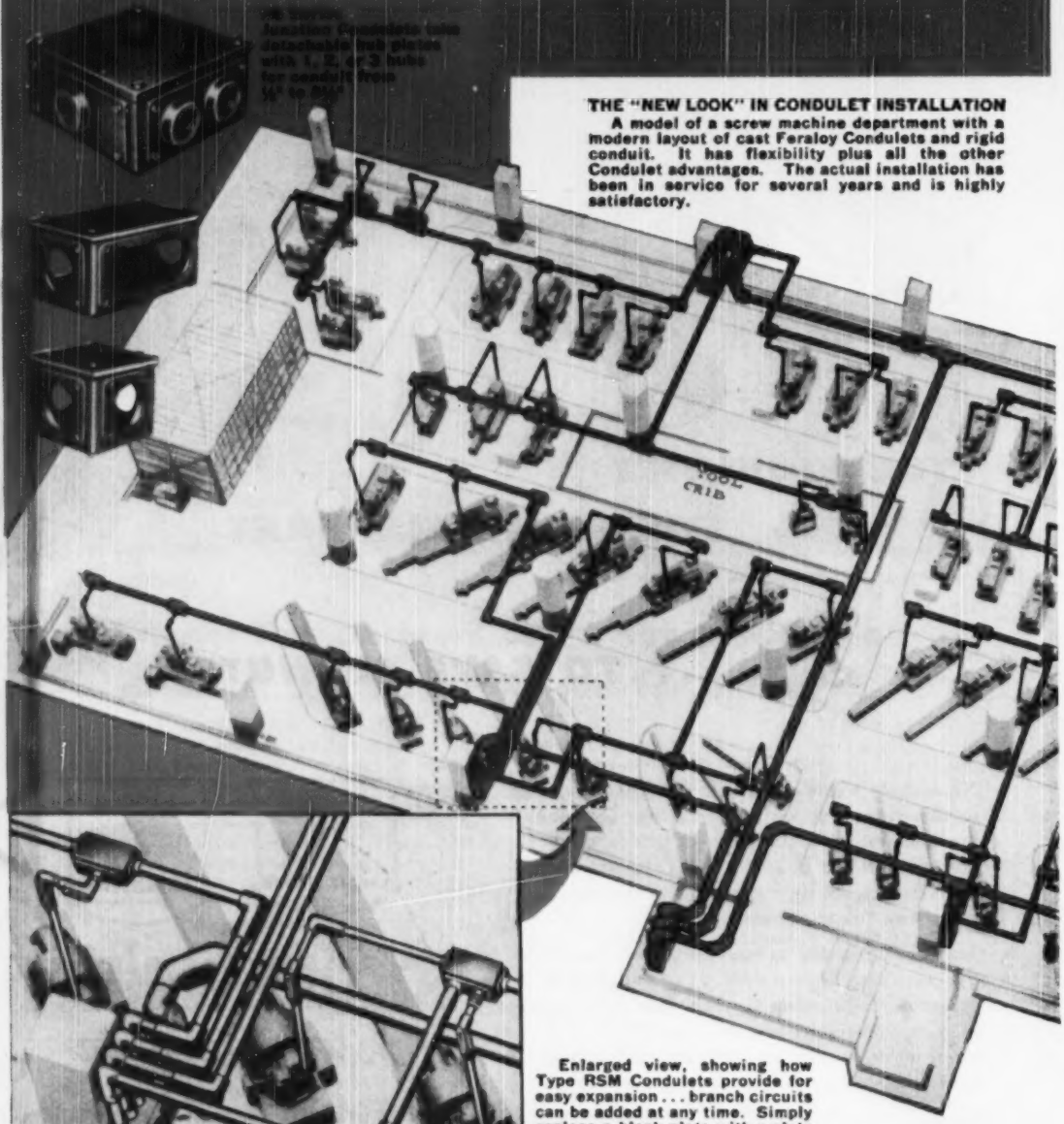
SOCONY-VACUUM

Correct Lubrication

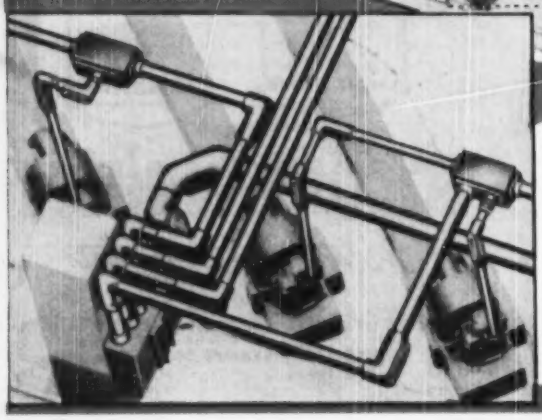
WORLD'S GREATEST LUBRICATION KNOWLEDGE AND ENGINEERING SERVICE

SOCONY-VACUUM OIL COMPANY, INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY, GENERAL PETROLEUM CORPORATION

for MODERN WIRING... the conduit and CONDULET*



THE "NEW LOOK" IN CONDULET INSTALLATION
A model of a screw machine department with a modern layout of cast Feraloy Condulets and rigid conduit. It has flexibility plus all the other Condulet advantages. The actual installation has been in service for several years and is highly satisfactory.

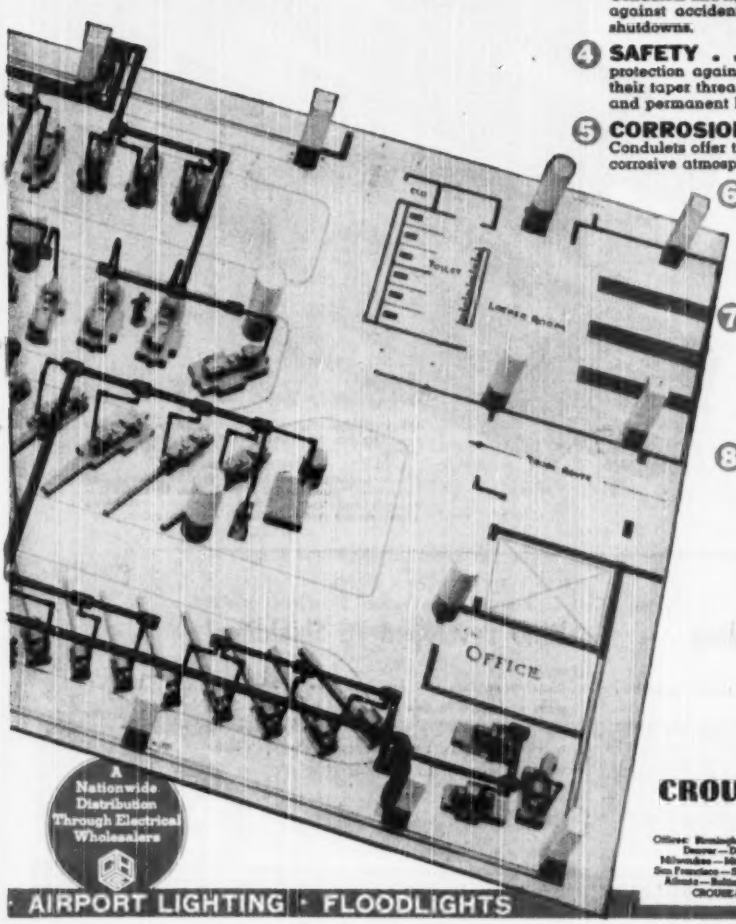


Enlarged view, showing how Type RSM Condulets provide for easy expansion... branch circuits can be added at any time. Simply replace a blank plate with a plate that has the required number and size of hubs.

CONDULETS • TRAFFIC SIGNALS •

method gives YOU definite advantages!

NEW ways of using the familiar Condulet and conduit material have produced outstanding results. Modern installation layouts meet industry's modern needs for flexibility while retaining the enduring protection and safety that can only be given by cast Feraloy Condulets and rigid conduit.



1 FLEXIBILITY . . . A modern Condulet installation, like the one illustrated below, provides for the vigorous growth and changing conditions of a modern industry. The RS Series Condulets with their detachable hub plates make it easy to change circuits or add additional circuits at any time.

2 UNIVERSAL APPLICATION . . . Galvanized Condulets and galvanized rigid conduit may be used under all atmospheric conditions and occupancies.

3 MECHANICAL PROTECTION . . . Cast Feraloy Condulets and rigid conduit provide the best possible protection against accidental damage to the wiring — prevents costly shutdowns.

4 SAFETY . . . A Condulet installation gives maximum protection against personal injury and fires. Condulets with their taper threaded hubs and rigid conduit provide a reliable and permanent low resistance path to ground.

5 CORROSION RESISTING . . . Cast Feraloy Condulets offer the best protection wherever moisture, dust or corrosive atmospheres are present.

6 ECONOMY . . . Direct comparison of Condulet and rigid circuit installations with other wiring methods show comparable installed costs. The durability, safety, and low maintenance cost of Condulet installations produces savings which pay dividends over the years.

7 QUALITY . . . All Condulets are built to Crouse-Hinds' high standard of quality with painstaking care by skilled craftsmen. Thousands of Condulet installations that are still in active service after twenty, thirty, forty or more years offer positive proof that the trademark CONDULET stands for reliability and long life.

8 VARIETY . . . Thousands of types and sizes of Condulets, plugs and receptacles, and lighting fixtures are listed in the Condulet Catalog, including a complete explosion-proof and dust-tight line for use in hazardous locations. There is a Condulet for every purpose.

On your next electrical layout, whether modernization or new construction, plan to get all of the benefits of sturdy cast Feraloy Condulets and rigid conduit. Send for additional information on modern Condulet installation.

*CONDULET is a coined word registered in the U.S. Patent Office. It designates a product made only by the Crouse-Hinds Company.

A Nationwide Distribution Through Electrical Wholesalers

CROUSE-HINDS COMPANY
Syracuse 1, N. Y.

Offices: Birmingham — Boston — Buffalo — Chicago — Cincinnati — Cleveland — Dallas — Denver — Detroit — Houston — Indianapolis — Kansas City — Los Angeles — Milwaukee — Minneapolis — New York — Philadelphia — Pittsburgh — Portland, Ore. — San Francisco — Seattle — St. Louis — Washington. Standard Distributors: Albany — Atlanta — Baltimore — Charlotte — New Orleans — Richmond, Va. — Salt Lake City

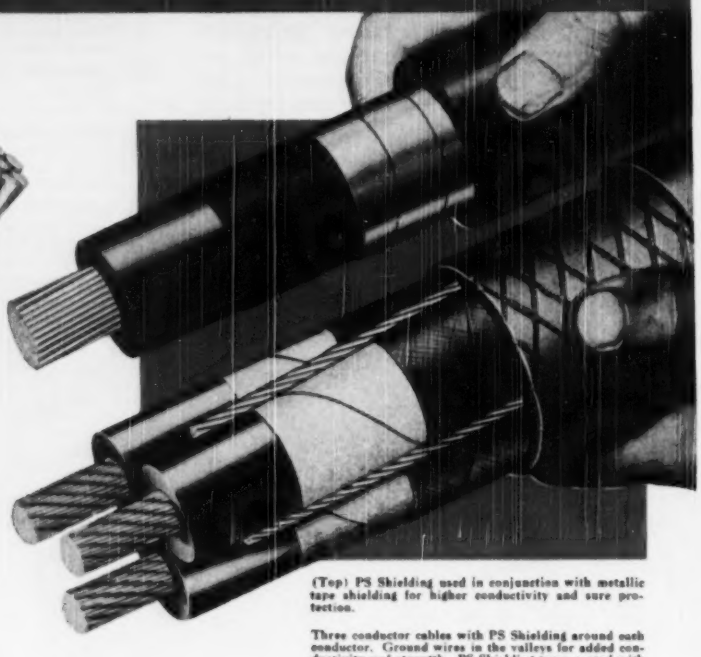
CROUSE-HINDS COMPANY OF CANADA, LTD., TORONTO, ONT.

AIRPORT LIGHTING · FLOODLIGHTS

What type of power cable

Unshielded? Metallic Shielded?

PS Shielding used directly over the conductor and also around the insulation.



(Top) PS Shielding used in conjunction with metallic tape shielding for higher conductivity and sure protection.

Three conductor cables with PS Shielding around each conductor. Ground wires in the valleys for added conductivity and strength. PS Shielding tapes coated with aluminum are used to identify a conducting tape.

Forms of PS Shielding

1. A thin coating or "skin" of conducting rubber.
2. A substantial sheath combining conductivity and mechanical protection.
3. A fibrous tape coated with conducting rubber.
4. A conducting paint or cement.

Who developed PS Shielding?

Research engineers at American Steel & Wire Company pioneered in this field many years ago. Since then, numerous other companies have been licensed to use conducting rubber tapes in electrical cable construction.

shall I use—

Non-Metallic PS Shielding?

● This subject has frequently come up for deliberation among outstanding power transmission engineers. They have thrown considerable light on the question and any buyer of cable will want to weigh the advantages and disadvantages of each type.

Unshielded insulated cable can generally be used up to 5000 volts without much trouble from corona and ozone formation.

Metallic Shielding in the form of metal tapes, wire braids and wire servings has been used with success under favorable conditions for cables 5000 volts and up. However, lack of flexibility may cause serious trouble. With expansion and contraction, bending and straightening, the metal shield tends to separate slightly from the insulation forming air gaps. Each air gap is a potential danger point causing spark discharges with corona and ozone formation—highly deteriorating to an organic insulating material.

Non-metallic PS Shielding with conducting tapes for cables 5000 volts and up, eliminates many of the weaknesses of metallic shielding. PS Shielding consists of a fibrous tape coated with a conducting rubber. It stays flexible—remains in intimate contact with the conductor or insulation. No air gaps can form and destructive sparkling is prevented. Corona is definitely eliminated—and so is ozone.

Type PS Shielding may be used alone, in combination with ground wires, or as a supplement to metallic shielding. We are now able to offer a conducting rubber compound that will provide improved shielding for any type of high-voltage cable.

Write for our booklet, "Type PS Semi-Conducting Shielding" which gives complete information.

AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OHIO

COLUMBIA STEEL COMPANY, SAN FRANCISCO

TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM, SOUTHERN DISTRIBUTORS

UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

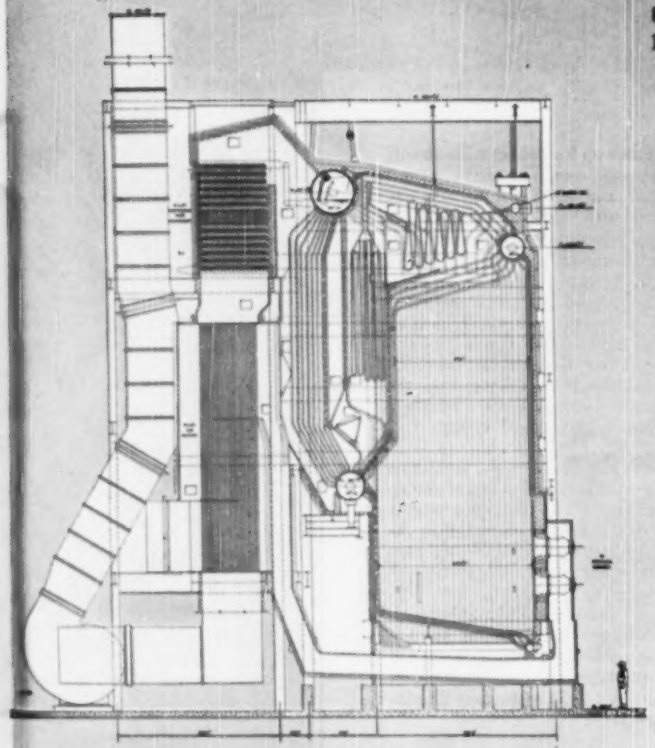
American Electrical Wire and Cable

UNITED STATES STEEL

4,540,000 lbs. of steam per hour

Eight different orders for Riley Units from Houston Lighting and Power Company . . . . .

To assure adequate electric power for the industries and people of Houston and South Texas, Houston Lighting and Power Company has had to tremendously expand their generating facilities. Riley was selected to furnish all of the steam generating units in this expansion program involving nine units with a total steam generating capacity of 4,540,000 pounds of steam per hour.



HOUSTON LIGHTING & POWER CO., West Junction Station
825,000 lbs./hr. Riley Steam Generating Unit
1050 lbs. Pressure—905°F. Steam Temperature
Ebasco Services, Inc., *Engineers*

RILEY at Houston

January 1938
GABLE STREET STATION
1—350,000 lbs./hr. 975 lbs. 910°F.

March 1940
GABLE STREET STATION
1—140,000 lbs./hr. 225 lbs. 500°F.

May 1941
WEST JUNCTION STATION
1—400,000 lbs./hr. 1000 lbs. 905°F.

June 1945
WEST JUNCTION STATION
1—400,000 lbs./hr. 1000 lbs. 905°F.

January 1947
GREENS BAYOU STATION
2—675,000 lbs./hr. 1050 lbs. 905°F.

June 1947
WEST JUNCTION STATION
1—825,000 lbs./hr. 1050 lbs. 905°F.

April 1948
GABLE STREET STATION
1—350,000 lbs./hr. 1000 lbs. 900°F.

October 1948
WEST JUNCTION STATION
1—825,000 lbs./hr. 1050 lbs. 905°F.

TRADE MARK Rx REGISTERED

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston · New York · Philadelphia · Washington · Buffalo · Pittsburgh · Cleveland · Detroit · Chicago
Cincinnati · Atlanta · New Orleans · Memphis · St. Louis · Kansas City · St. Paul · Tulsa · Houston
Denver · Salt Lake City · Los Angeles · Portland · Seattle

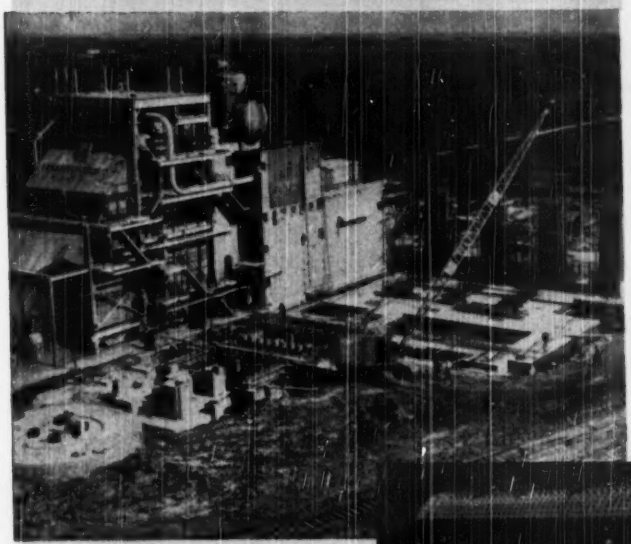
BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS

from the 9 RILEY units at Houston

COMPARISON — Actual and predicted results
675,000 lbs./hr. Riley Unit—Greens Bayou Station

	Actual	Predicted
Temperature Feed Water	359.6	
Temperature Water to Boiler	452.2	452
Temperature Gas Leaving Airheater	314.3	370
Total Air Pressure	8.2	9.1
Total Draft Loss	6.9	7.7
Steam Temperature	905	905
Efficiency	84.97	82.1

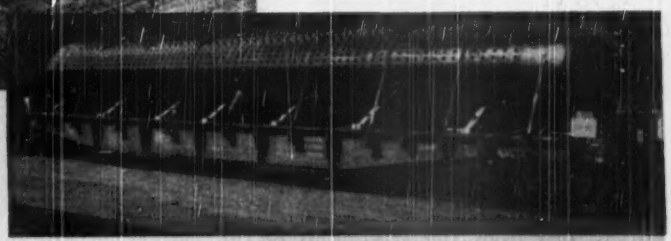
Steam Output—643,200 lbs./hr.



View showing first 400,000 lbs./hr. Riley Unit at West Junction Station. Two 400,000 lbs./hr. and two 850,000 lbs./hr. Riley Units are now installed at this plant.

All of these public utilities have installed Riley Steam Generating Equipment:

PUBLIC SERVICE CO. OF INDIANA	
Dresser Station	1—300,000 lbs./hr.
Edwardsport Station	3—400,000 lbs./hr.
Noblesville Station	3—300,000 lbs./hr.
NORTHERN VIRGINIA POWER CO.	
Riverton Station	1—350,000 lbs./hr.
CENTRAL ILLINOIS LIGHT CO.	
R. S. Wallace Station	1—600,000 lbs./hr.
R. S. Wallace Station	1—375,000 lbs./hr.
R. S. Wallace Station	3—300,000 lbs./hr.
ARKANSAS POWER & LIGHT CO.	
Cecil Lynch Station	1—650,000 lbs./hr.
UTAH POWER & LIGHT CO.	
Orem Station	1—450,000 lbs./hr.
Jordan Station	1—630,000 lbs./hr.
WORCESTER COUNTY ELECTRIC CO.	
Webster Street Station	1—325,000 lbs./hr.
WEST PENN POWER CO.	
Milesburg Station	2—210,000 lbs./hr.
INTERSTATE POWER CO.	
Lansing Station	2—120,000 lbs./hr.
Fox Lake Station	2—120,000 lbs./hr.
Clinton Station	1— 45,000 lbs./hr.
NEW ORLEANS PUBLIC SERVICE CO.	
Market Street Station	1—330,000 lbs./hr.
IOWA-ILLINOIS GAS & ELECTRIC CO.	
Riverside Station	3—250,000 lbs./hr.
Corslville Station	1— 60,000 lbs./hr.
CITY OF LOS ANGELES	
Harbor Steam Station	3—625,000 lbs./hr.
Harbor Steam Station	2—675,000 lbs./hr.
MISSISSIPPI POWER CO.	
Plant Eaton	3—230,000 lbs./hr.
OTTER TAIL POWER CO.	
Kidder Station	2—100,000 lbs./hr.
Crookston Station	2— 75,000 lbs./hr.
Devils Lake Station	1— 75,000 lbs./hr.
Canby Station	1— 75,000 lbs./hr.
OHIO EDISON CO.	
Mad River Station	1—250,000 lbs./hr.
SOUTH CAROLINA POWER CO.	
Plant Hagood	2—230,000 lbs./hr.
GULF POWER CO.	
Pensacola Station	2—230,000 lbs./hr.
UNION ELECTRIC CO. OF MISSOURI	
Ashley Street Station	2—285,000 lbs./hr.
Ashley Street Station	3—310,000 lbs./hr.
CENTRAL OHIO LIGHT & POWER CO.	
Woodcock Station	1—120,000 lbs./hr.
Woodcock Station	1— 90,000 lbs./hr.
Woodcock Station	2— 60,000 lbs./hr.
PENNSYLVANIA ELECTRIC CO.	
Williamsburg Station	1—300,000 lbs./hr.
CAROLINA POWER & LIGHT CO.	
Moncure Station	2—330,000 lbs./hr.



Steam Drum for Riley Unit at West Junction, 66 in. dia., 55 ft. long, 3 $\frac{1}{16}$ in. thick

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large [illegible] costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD [illegible] SETTINGS • AIR HEATERS

"Street lighting in a Florida town is an INVESTMENT"

says **A. W. Higgins,** *President*
Florida Power Corporation
St. Petersburg, Florida

"OUR company plays an important part in the efforts to attract new citizens and new business to our State. We believe good street lighting helps . . . not only in making our cities safer, but in making them more attractive. We, as a utility, believe it's good business, too . . . for the community, for the citizen, and from the standpoint of the visitors who are so numerous in the territory we serve."

FOR MORE FACTS . . . *Write for your free copy of "Planned Progress in Street Lighting".*

The Street and Traffic Safety Lighting Bureau, 155 East 44th St., New York 17, N. Y.

R&IE

type TTR-49

69 Kv.
600 AMP.

Before you buy a switch that gives you less...

CHECK the FACTS!

THE NEW TTR-49 WAS DESIGNED WITH YOUR PRESENT DAY INCREASING OPERATING PROBLEMS IN MIND

1 **JAW CONTACT**—Hi-Pressure, Hi-Thermal capacity silver to copper contact. ONLY ONE BREAK CONTACT on the switch. Copper and beryllium jaw—copper for thermal capacity and beryllium for strength and resilience. Here's maximum protection against fault current damage.

2 **HINGE CONTACT**—Completely enclosed and weather sealed Hi-Pressure, Hi-Thermal capacity, silver to copper Hinge Contact. Continuous, annular, constant electrical and mechanical contact at all times. Eliminates second break contact with its multiplied problems and maintenance.

3 **BLADE OPERATING MECHANISM**—Simplified and "streamlined" to attain a simple harmonic, accurately controlled blade motion. Special pin fastenings, snap rings, and rivets have been eliminated from moving parts. Universal blade balance on 69 Kv. and above.

4 **BLADE**—Extra heavy, hard drawn tubular copper with integral, formed contact end. Solid current path from jaw to hinge contact.

5 **TERMINALS**—Four half-inch bolts on 1¾ x 1¾ inch centers permit NEMA standard 600 or 1200 Ampere clamping and R&IE Type "UC" universal clamps. Both terminals equal height from base.

6 **BEARING**—Aluminum housed, weather-sealed, stainless ball—requires no lubrication.

RAILWAY and INDUSTRIAL ENGINEERING CO.
GREENSBURG, PA.

IN CANADA—
EASTERN POWER DEVICES LIMITED, TORONTO

The Quick List

CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS

DISCONNECTING SWITCHES INDOOR AND OUTDOOR

HORN GAP SWITCHES

INTERRUPTER SWITCHES

CUTOUTS AND THERMO RUPTERS

DISTRIBUTION EQUIPMENT

SWITCH OPERATING MECHANISMS

SUBSTATION

OPEN OR ENCLOSED ISOLATED PHASE HEAVY DUTY BUSES

KIRK INTERLOCK SYSTEMS

AUTOMATIC SWITCHING EQUIPMENT

METAL CUBICLES

TESTING DEVICES

"Heavy-Duty Engineered, eh... WHAT'S IN IT FOR ME?"

What does it mean when we say every new International Truck, large or small, is heavy-duty engineered? That means every one of the thousands of parts of each truck is engineered with extra stamina. You get extra ruggedness that pays off in lower-cost performance . . . longer truck life.

It's the same plus value that has kept Internationals first in heavy-duty truck sales for 18 straight years. And you know Internationals are built to last—over half the International Trucks built in the last 43 years are *still in service.*

You get a brand new kind of comfort in every new International Truck. The Comfo-Vision cab, standard on every model, is "the roomiest cab on the road." You get full front visibility through the one-piece, curved Sweepsight windshield. And these new Internationals are a pleasure to handle with an all-new steering system that gives you more positive control and a shorter turning radius.

Stop in at your nearest International Truck dealer or branch and see *all* the big features, soon.

International Harvester Builds McCormick Farm Equipment and Farmall Tractors...Motor Trucks Industrial Power...Refrigerators and Freezers

Tune in James Melton and "Harvest of Stars" NBC, Sunday afternoons

ALL NEW, ALL PROVED

INTERNATIONAL TRUCKS

INTERNATIONAL HARVESTER COMPANY CHICAGO

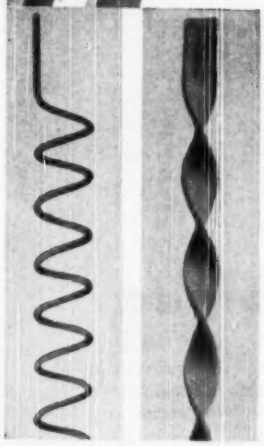
NOW... Unexcelled flexibility with high-heat resistance...

DELTABESTON® MAGNET WIRE

Now, General Electric makes available to manufacturers of electrical equipment a *radically-improved* asbestos-insulated magnet wire—one that requires much less winding space than conventional asbestos-insulated wire, while affording the excellent dielectric strength and heat-resistant features of Class B insulation.

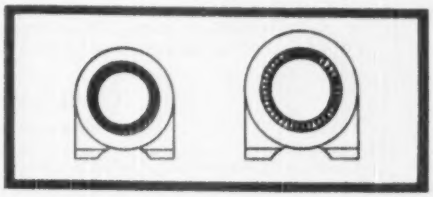
Improved Deltabeston magnet wire permits more voltage per mil of insulation thickness . . . lower maximum insulation increases . . . smaller over-all size and closer control of dimensions than ever before possible with asbestos-insulated magnet wire. In addition, improved Deltabeston magnet wire has more uniform insulation walls and better bending properties than obtainable with other types of high-heat-resistant insulation.

General Electric improved asbestos-insulated Deltabeston magnet wire is supplied in a wide range of sizes in round, square, and rectangular shapes. For additional information, write Section W17-827, Construction Materials Department, General Electric Company, Bridgeport 2, Connecticut.



BETTER BENDING PROPERTIES—Improved G-E Deltabeston magnet wire can be looped, twisted, flexed, or bent edgewise without signs of the brittleness or yarn separation common to most other types of high-heat-resistant magnet wire.

LESS WINDING SPACE—Improved G-E Deltabeston heat-resistant magnet wire, with thin-wall asbestos insulation, provides more copper per unit cross-section—coils for motors and generators can be made smaller, without reduction in capacity.



You can put your confidence in—

GENERAL ELECTRIC

CREOSOTE OIL

leads the parade

● It's only natural to look closely at service records when you specify a preservative for your poles and crossarms. And no other preservative can match creosote oil's records of service in adding years of life to treated wood and reducing replacement costs.

These records are important reasons why the wood-preserving industry uses far more creosote oil every year than all other preservatives combined. And they're important reasons, too, why you should insist on this *tested* preservative.

When specifying creosote oil, insist on U·S·S Creosote Oil. It's a completely *uniform* product, made to give you uniformly good results. For more information, contact our nearest sales office listed below.

COAL CHEMICAL SALES DIVISION

UNITED STATES STEEL CORPORATION SUBSIDIARIES

71 Broadway, New York 6, N. Y.

208 South La Salle St., Chicago 90, Ill. 1509 Terminal Tower, Cleveland 13, Ohio
Brown-Marx Building, Birmingham 2, Ala. 25 Beale St., San Francisco 5, Calif.
United States Steel Export Company, New York

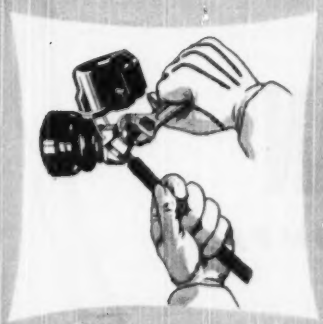
USS

CREOSOTE OIL

UNITED STATES STEEL

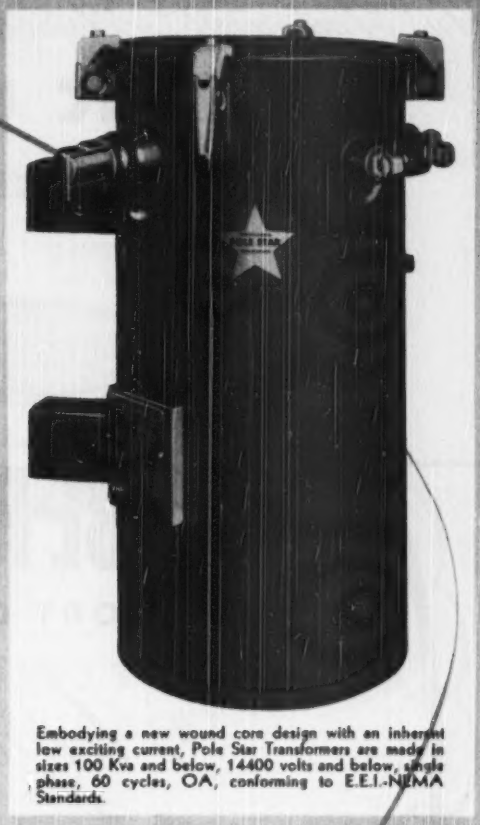
NO POCKETS ON THE POLE STAR*

Terminals receive line leads at the same angle as pocket-type bushings. Solderless connectors are forged of naval brass to assure a rugged connector of uniform strength. Heavy bakelite insulating caps are secured to the solderless connectors by spring wire hinges.



Caps are self-supporting above the terminals. Line connections are made with a standard wrench. Solderless connectors are completely exposed so lineman can see the connection he is making. Caps are closed by hand pressure and completely cover bushing terminals.

If you want to know more about the Pole Star Transformer, write to us for Catalog No. 349.



Embodying a new wound core design with an inherent low exciting current, Pole Star Transformers are made in sizes 100 Kva and below, 14400 volts and below, single phase, 60 cycles, OA, conforming to E.E.I.-NEMA Standards.

Years ago, when bushings were neither weatherproof nor leakproof, pockets and pocket bushings were required on Distribution Transformers. In designing the Pole Star Transformer, however, Pennsylvania Development Engineers replaced the high voltage pockets and pocket bushings with sturdy, streamlined sidewall bushings. This was done because today bushings are provided with stud-type terminals and gasket seals which insure pressure tight joints and sealed tank construction. This is another one of the modern improvements incorporated into the Pennsylvania Pole Star Transformer. It is another example of Pennsylvania's Engineering Ingenuity.

P. S. Let the Pole Star be your guide.

Pennsylvania

TRANSFORMER COMPANY

CANONSBURG, PENNA. (Greater Pittsburgh District)

An Important Announcement to America's—

ELECTRIC UTILITIES

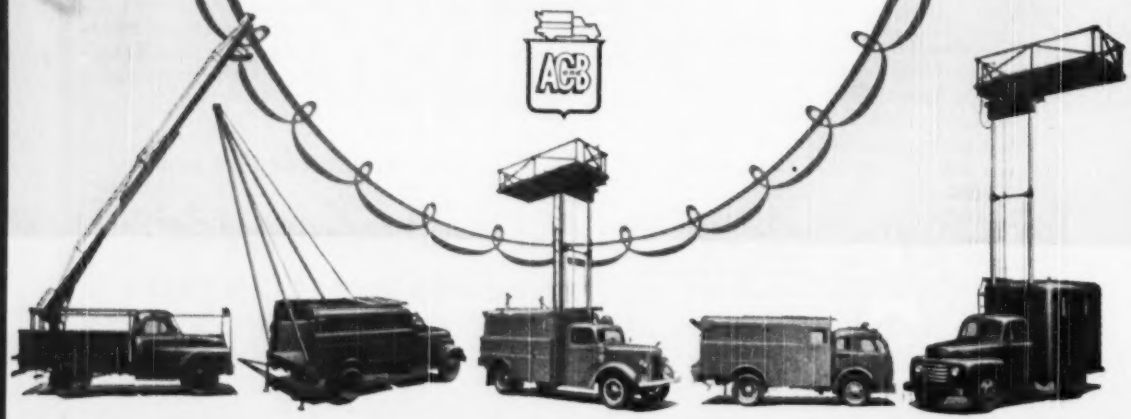
ALL-STEEL POWERS
PUBLIC UTILITY BODIES

McCABE-POWERS
AUTO BODY COMPANY

Acquires

AMERICAN
COACH & BODY COMPANY

ACB



A typical group of the many diversified products which the

The Public Utility Division of
McCabe-Powers Auto Body Co.
will continue to serve America's

ELECTRIC UTILITIES

as the—

POWERS *American*

DIVISION

PUBLIC UTILITY BODIES AND EQUIPMENT

McCabe-Powers Auto Body Company, manufacturer of transportation equipment since 1871, has within the last twenty years specialized in the production of truck bodies designed for utility work. With its acquisition of the American Coach and Body Company, one of America's principal utility body builders, McCabe-Powers can now supply *any* type of truck body or automotive equipment required by the public utility industry.

Numerous products of McCabe-Powers and American Coach are similar . . . production of many will be continued, while others will be redesigned and improved. The combined knowledge and facilities of both companies will also be utilized in the development of new, and even more efficient truck equipment for utility work.

The "POWERS-American" Utility Body Division of McCabe-Powers will have manufacturing and distributing points located conveniently throughout the country. It looks forward to the opportunity of working even more closely with America's Public Utilities and welcomes the responsibility of developing improved truck bodies and equipment for use in utility construction and maintenance operations.

McCABE-POWERS AUTO BODY COMPANY
MAIN PLANT AND GENERAL OFFICES 5900 N. BROADWAY, ST. LOUIS 15, MO.

"POWERS American" Division provides for the Public Utility industries.

Long condenser life starts right here!

CHASE ANTIMONIAL ADMIRALTY

(a patented alloy)

Thousands of installations since 1935 *prove* that long service life starts with Chase Antimonial Admiralty. Here's why:

Admiralty with an antimonial content of less than .007% (the minimum set forth in Chase Patent No. 2,061,921) cannot be depended on to guard against dezincification under all conditions. For a wide range of applications, .015% is the smallest safe amount. Chase makes *sure* you get this minimum despite normal commerical variations —by using a nominal content of .035%.

That's the time-tested Antimonial Admiralty—patented by Chase, made only by Chase. Get the facts today.

Special stocks of ANTIMONIAL ADMIRALTY Condenser Tubes in Chase Warehouses: NEW YORK, BALTIMORE, NEW ORLEANS, LOS ANGELES, SAN FRANCISCO

also carried by—
Vinson Supply Co., Tulsa
Standard Brass & Mfg. Co., Houston

Chase

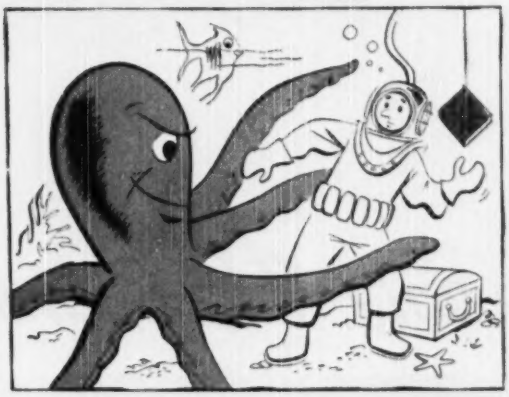
the Nation's Headquarters for
BRASS & COPPER

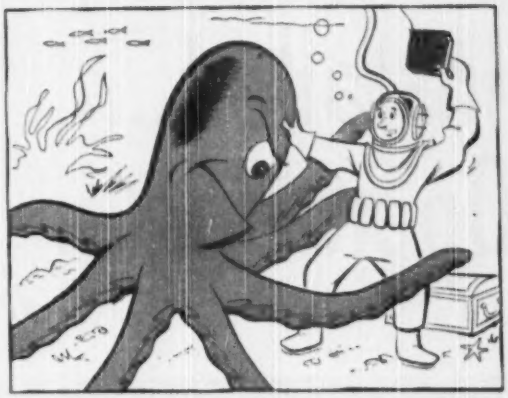
WATERBURY 20 CONNECTICUT — SUBSIDIARY OF KENNECOTT COPPER CORPORATION

THIS IS THE CHASE NETWORK . . . handiest way to buy brass

ALBANY ATLANTA BALTIMORE BOSTON CHICAGO CINCINNATI CLEVELAND DALLAS DENVER DETROIT HOUSTON INDIANAPOLIS KANSAS CITY MO. LOS ANGELES MILWAUKEE MINNEAPOLIS NEWARK NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH PROVIDENCE ROCHESTER ST. LOUIS SAN FRANCISCO SEATTLE WATERBURY

You can do a *lot*





with a little

GOLD SEAL TAPE

Rush job? Use Gold Seal, it's quick and easy to apply. It *goes further* too! Because there's no waste, you get full value from every roll.

Laboratory-control of production assures plenty of tack, from end to end. Gold Seal sticks to the job, conforming readily to the contour of the work.

A pleasure to use, it tears evenly and quickly, does not ravel. Gives a tighter, longer-lasting bond. Does not dry out or peel.

Linemen, electricians,—any tape users like Gold Seal. It helps them get better taped joints in less time . . . in any weather. Its cellophane wrapping keeps it factory *fresh*. You can buy Gold Seal in convenient ten-roll containers, or by the single roll. Jenkins Bros. (Rubber Div.), 100 Park Ave., New York 17, N. Y.

Jenkins Bros. also make Diamond Seal Friction and Rubber Tapes which meet both ASTM and Federal Specifications.

JENKINS *Gold Seal Tapes*

FRICTION and RUBBER TAPES

MADE BY JENKINS BROS., MAKERS OF FAMOUS JENKINS VALVES

Unloaded... Installed... Operating... *in only 48 hours*

Recently a large steel corporation in Kansas City, Mo., ordered this nine-frame, 600 volt I-T-E secondary distribution switchboard as part of a modernization program to replace obsolete distribution equipment and provide additional interrupting capacity.

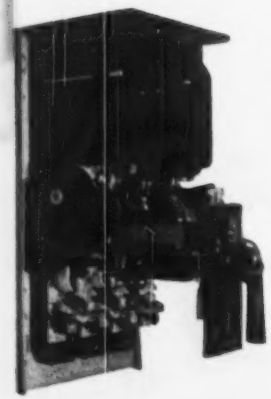
A quick changeover was essential . . .

Shortly after the switchboard arrived at a Kansas City freight yard, it was unloaded from the flat car and transferred by truck to the switchhouse, positioned relative to points of cable entry, main connections were made, and the power switch thrown—*all within 48 hours!*

This switchboard was installed easily, quickly and economically because it was *completely assembled* and *thoroughly tested* at the I-T-E factory prior to shipment. I-T-E engineered the job, supplied all components, installed all internal wiring, shipped the board as a complete unit. Only external cable connections were required after installation.

Here's proof that *you* can modernize *your* plant easily, quickly and economically. And there are many other benefits you get with I-T-E Low Voltage Switchgear. Here are a few:

- ***CAREFUL APPLICATION:*** I-T-E application engineers carefully apply the equipment to your needs and see that it is built to fit your requirements. All components that go into I-T-E switchboards are the finest obtainable, carefully coordinated into efficient functional units.
- ***ATTRACTIVE APPEARANCE:*** When you purchase other equipment you select it partly for appearance because you know how important it is to the efficiency of your personnel. Your plant personnel will react just as favorably to more attractive switchgear.
- ***DEPENDABLE CIRCUIT BREAKERS:*** No switchboard can be more dependable than the circuit breakers in it. I-T-E circuit breakers offer you the trouble-free protection so important to proper plant operation.



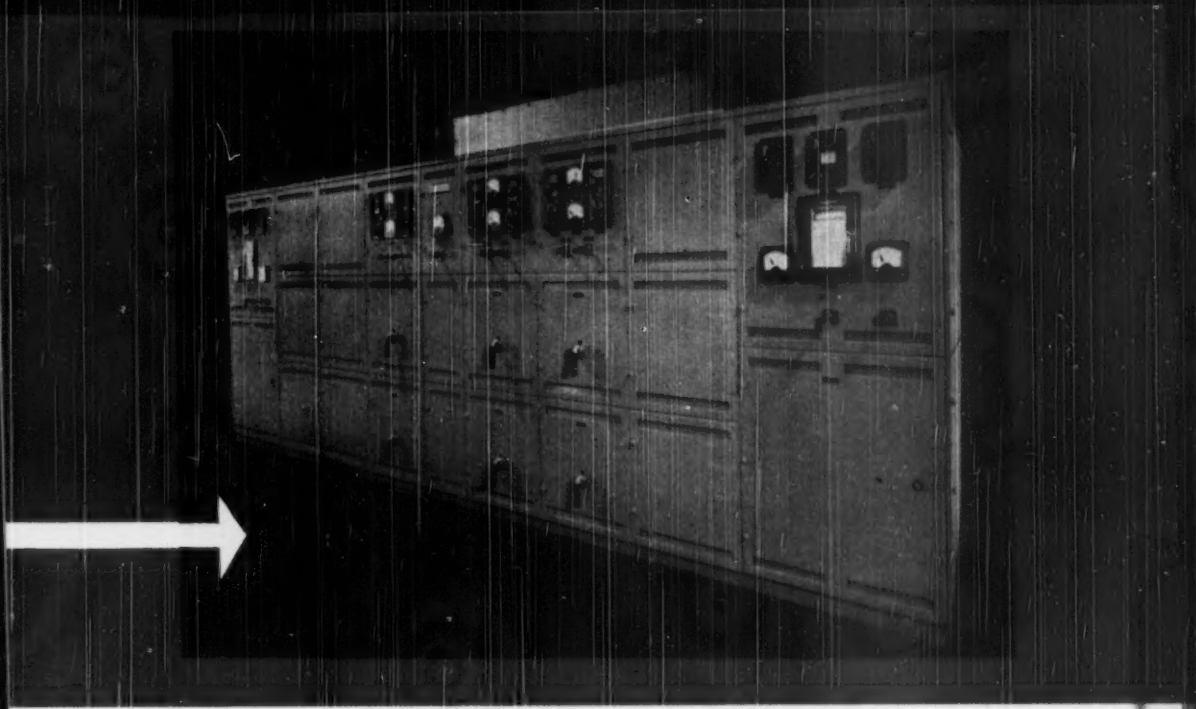
◀ *Positive-acting Air Circuit Breakers*
Type KB Breaker. 25,000 RMS Amp. Interrupting Rating. 600 Amp. Continuous Rating. 2, 3, or 4 Poles. Manually or Electrically operated.

Send for these descriptive bulletins: ▶

BULLETIN 6003-D: A complete reference guide to I-T-E 600 V. Switchgear Assemblies.

BULLETIN 7000-A: Describes I-T-E's newest 5 KV Switchgear.

Get both bulletins—ask your local I-T-E Representative, or write I-T-E General Offices.



MULTUMITE SWITCHGEAR IS COMPACT . . . EFFICIENT!

The compactness of I-T-E Multumite assemblies is well illustrated in the above photo. Behind the attractive exterior of this switchboard are strong, efficient breakers and components—designed and built to provide positive protection of secondary distribution systems.

Electrically welded steel frames—one for each vertical group of breakers—are bolted together on a continuous channel-iron sill (furnished by I-T-E) to make a strong, rigid, and self-supporting structure. In addition to keeping the switchboard rigid in transit, the sill provides an excellent vermin-proof base for installation.

For extra protection of equipment, each breaker is in a separate metal compartment formed by horizontal and vertical steel barriers welded to the frame, exterior metal panels, and the metal back of breaker itself.

This bus compartment is designed for easy access ▶

Here's another reason installation of I-T-E Low Voltage Switchgear is so easy. A spacious bus compartment with a single horizontal bus facilitates cable connections, makes them easy to get to, provides more space for outgoing cables. Full-height hinged doors swing wide, can be removed easily. The whole compartment is *planned* for maximum accessibility and greater convenience!

I-T-E

R&IE

For *more dependable* Switchgear

specify I-T-E!

I-T-E Circuit Breaker Company • 19th & Hamilton Streets • Philadelphia 30, Pa.

Power Switching Equipment: Railway and Industrial Engineering Co., Greensburg, Pa.

Canadian Mfg. & Sales: Eastern Power Devices, Ltd., Toronto • Export Sales: Philips Export Corp., New York

SWITCHGEAR • UNIT SUBSTATIONS • ISOLATED PHASE BUS STRUCTURES • CIRCUIT BREAKERS • MECHANICAL RECTIFIERS • RESISTORS • SPECIAL PRODUCTS

Make these substantial savings on guy wires

• Today, learn how Preformed Guy Wires cut installation time in half . . . save on materials . . . increase strength of guy assemblies.

NO TOOLS. Forget about expensive clamps and tools. Save the time wasted assembling dead ends and tightening bolts. Preformed Armor Rods now come pre-assembled into guy wires. Simply attach to your insulator and angle thimble bolt . . . by hand!

Any lineman . . . regardless of his skill . . . makes a perfect job every time. No tools, no clips, no clamps. You cut installation time in half . . . save on tool costs, too.

LOWER MATERIAL COSTS. You use only half as much strand in Preformed Guy Assemblies. Savings average up to 50% over ordinary guy assemblies.

STRONGER THAN THE STRAND ITSELF. Authoritative tests, by one of the country's largest cable testing laboratories, prove that Preformed Dead Ends, applied by hand, exceed the guy strand in tensile strength! Preformed Dead Ends grip the strand uniformly and over a larger area than ordinary clamps.

START NOW TO MAKE THESE SAVINGS. Benefit by the experience of hundreds of utilities now using Preformed Armor Rods. Get complete data by writing Preformed Line Products Company, 1051 Power Avenue, Cleveland 14, O.

• Preformed armor rods are for use under patent No. 2,275,019 . . . other patents pending.

PREFORMED

PLP LINE PRODUCTS CO.

1051 POWER AVE. • CLEVELAND 14, OHIO

You wouldn't hunt rabbits with a cannon!

CONTACTOR — Device for repeatedly establishing and interrupting an electric power circuit (NEMA definition).

RELAY — Device operative by variations of one circuit to effect operation of device in same or other circuit (NEMA).

... So why use a BIG contactor to do this relay's job?

Some control users are hunting rabbits with a cannon . . . when they use a power contactor to do a small relay's job. Sometimes, this is done as an escape from previous troubles with inadequate relays.

Nevertheless, it is poor engineering! When you add size you add weight . . . and also wear and tear.

Why pay extra money and waste panel space with a power contactor, when over 1,000,000 Allen-Bradley solenoid relays have proved themselves entirely adequate for any relay service.

Better investigate why Allen-Bradley relay users enjoy such trouble-free performance. Just ask for Bulletin 700. Allen-Bradley Co., 1316 S. Second Street, Milwaukee 4, Wisconsin.

A-B

ALLEN-BRADLEY

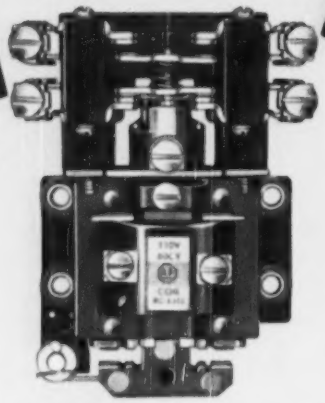
BULLETIN 700 RELAYS

QUALITY

450 M R

Over 1,000,000 ALLEN-BRADLEY RELAYS

in precision control applications



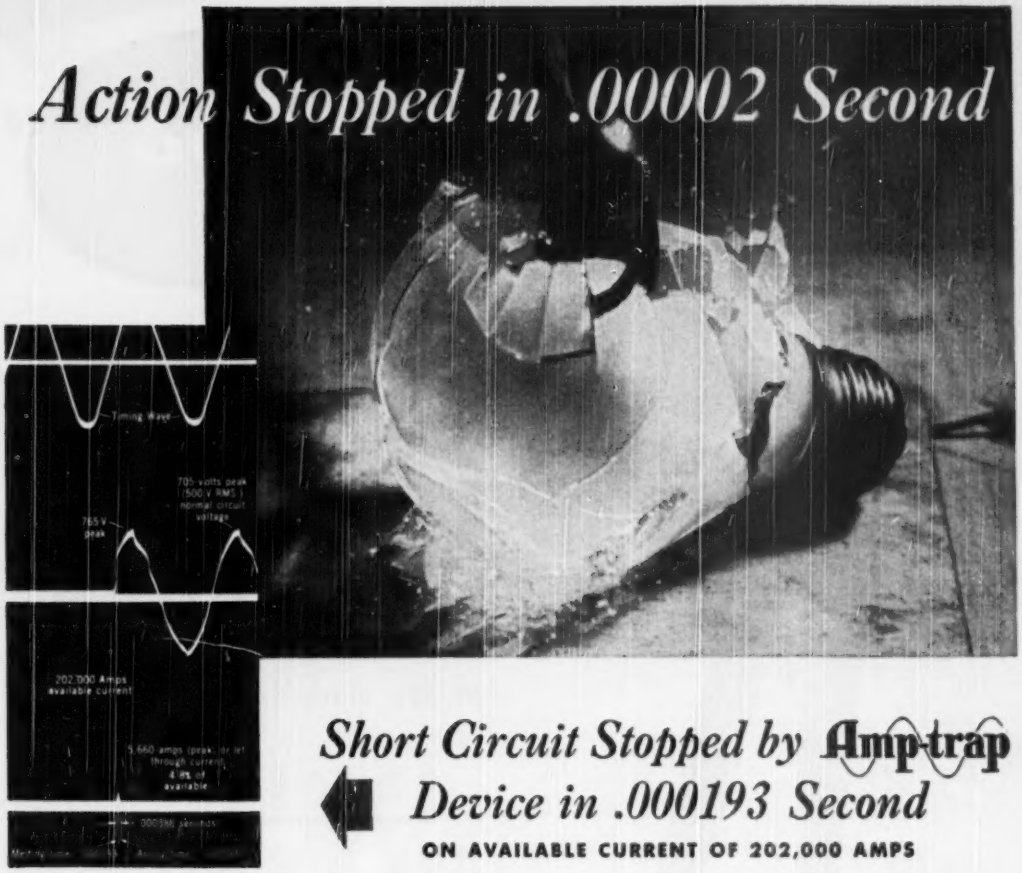
Ten hundred thousand relays are a lot of relays . . . all at work on machine tools and other responsible jobs . . . that's the success story of Allen-Bradley Bulletin 700 Solenoid Relays since they were introduced, eighteen years ago. Ask about them . . . anywhere . . . and you will find Bulletin 700 Solenoid Relays are dependable . . . accurate . . . consistent . . . long lived . . . and trouble free.

Don't buy a contactor to do a relay's job. Standardize on Bulletin 700 Relays . . . and be safe.

Allen-Bradley Co.
1316 S. Second St.
Milwaukee 4, Wis.

ALLEN-BRADLEY
RELAYS
QUALITY

Action Stopped in .00002 Second


Timing Wave
705 volts peak (500 V RMS) normal circuit voltage
765 V peak
202,000 Amps available current
5,660 amps (peak) let through current; 4.8% of available

Interrupting test conditions: 3 phase, 60 cycle 500 volts, 12% power factor, 118,000 RMS amps available short circuit current (202,000 amps peak).

Certified test results: Short circuit stopped in .000193 second. Fault cleared in .000386 second by 30 amp 600 volt Amp-trap current limiter; recovery voltage — 765 volts peak; let-through current — 5,660 amps peak, only 4.8% of available current. Complete report on request.

Short Circuit Stopped by Amp-trap *Device in .000193 Second*

ON AVAILABLE CURRENT OF 202,000 AMPS

Almost as fast as the blink of stroboscopic light that stopped the action in the above photograph in 1/50,000 second, Shawmut Amp-trap current limiters can interrupt short circuit currents up to 255,000 amperes on circuits up to 600 volts AC or DC *. . . without noise or flame.*

How it works. The Shawmut Amp-trap principle consists of a silver link embedded in quartz sand. The short circuit current melts the link while the quartz sand, absorbing the heat of the arc, instantaneously changes into glass of high dielectric value.

Investigate: Amp-trap current limiters come in sizes from ¼ amp to 3000 amps for application on circuits up to 600 volts AC or DC. Use the coupon below for more information about this new, money-saving form of circuit protection.

SHAWMUT Amp-trap
CURRENT LIMITERS

. . . the ultimate in low-voltage circuit protection

SINCE 1893

The Most Complete Line of Circuit-Protection Devices

SHAWMUT CIRCUIT-MATCHED CURRENT LIMITERS

Insure More Accurately Engineered Protection For Any Circuit

THE CHASE-SHAWMUT COMPANY
370 Merrimac Street, Newburyport, Massachusetts

I am interested in more information about the Shawmut Amp-trap device, particularly for

- ☐ new electrical installations
- ☐ old electrical systems
- ☐ incorporation in such equipment as switchgear, station auxiliary buses, motor starters, bus ducts and cable systems

Name.....Title.....

Firm.....

Street.....

City.....Zone.....State.....

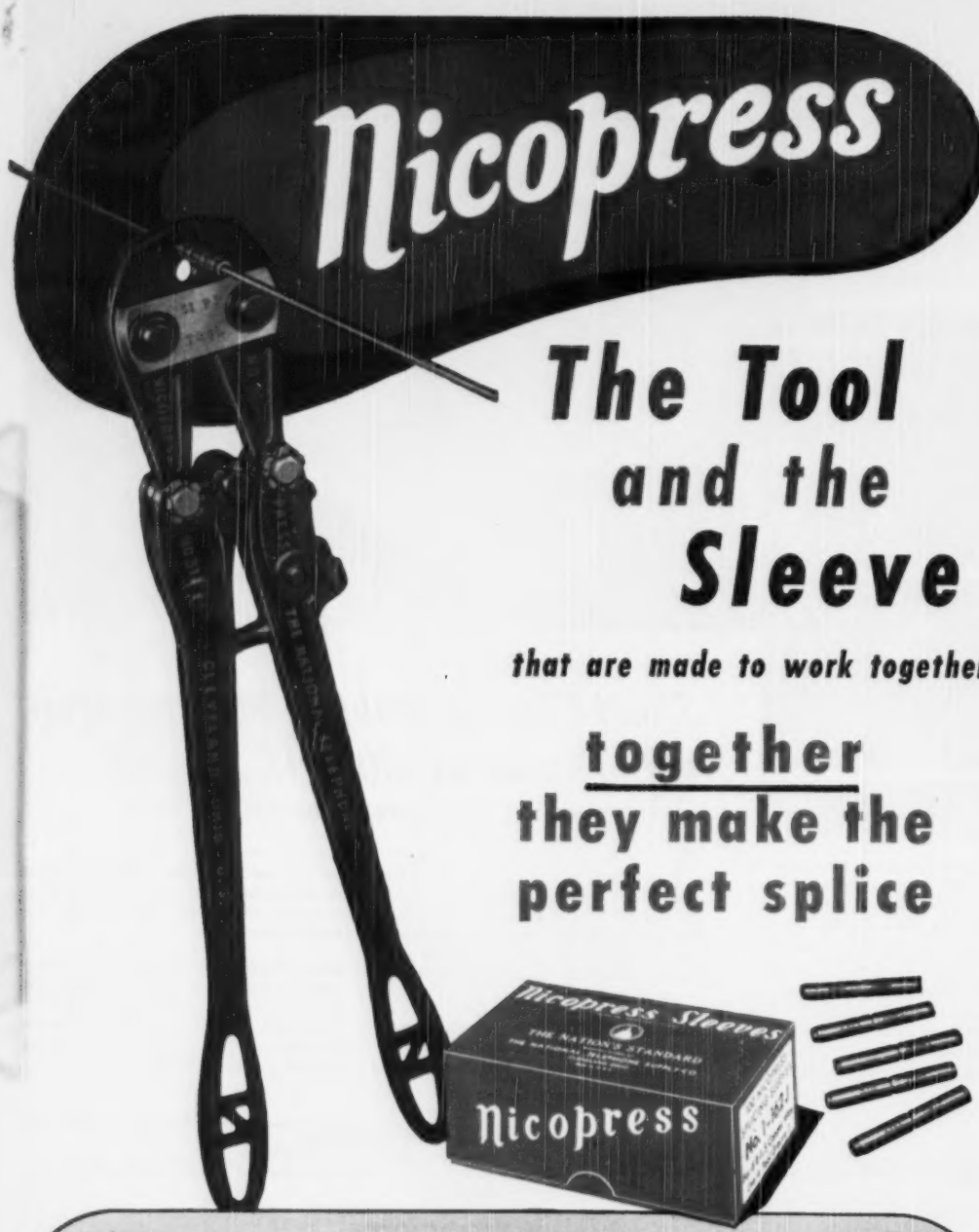
☐ Check here for information on C-Q-T, the startling new Plug Fuse with Time-Delay sufficient to start a large washing machine, yet sensitive enough to protect lamp cords.

Nicopress

The Tool and the Sleeve

that are made to work together

together they make the perfect splice



The National Telephone Supply Company

5100 SUPERIOR AVENUE • CLEVELAND 3, OHIO

Canadian Mfr.—N. SLATER CO., LTD., HAMILTON, ONT., CANADA

Export Distributor—INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

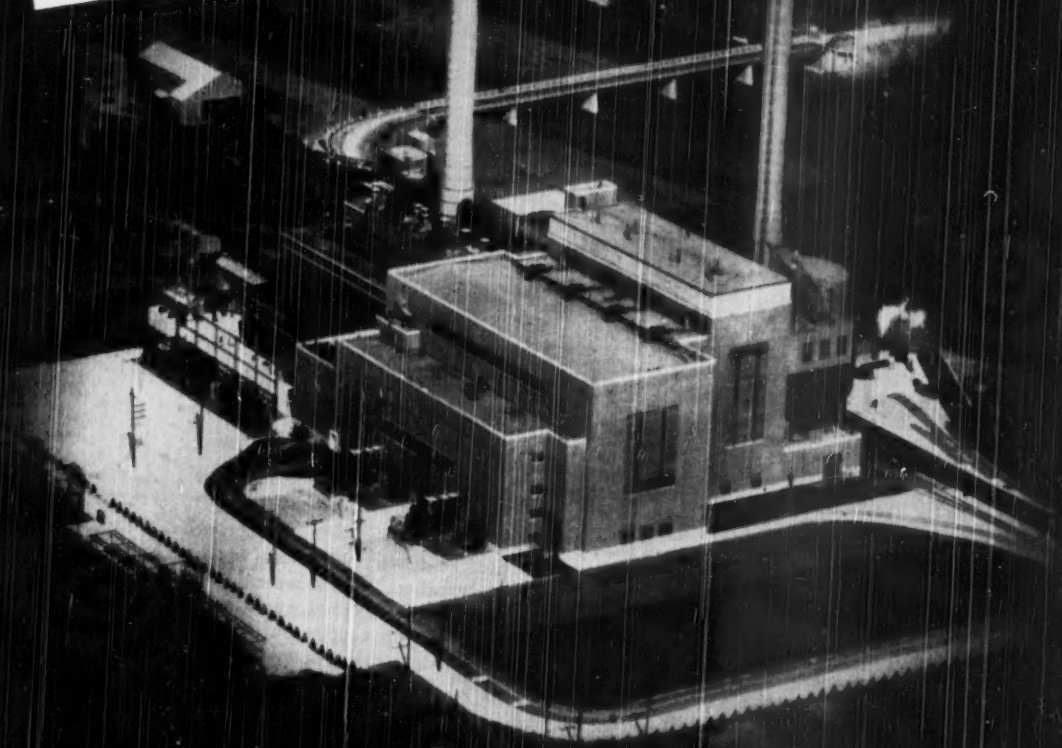
Nicopress is the Registered Trade Mark of The National Telephone Supply Company

DRAVO CORPORATION

POWER DEPARTMENT

Let us be your Construction Department

ENGINEERING CONSTRUCTORS



PHILADELPHIA ELECTRIC COMPANY'S 180,000 kw power station at Barbadoes Island, Norristown, Pennsylvania. The additional facilities recently constructed by the Power Department of Dravo Corporation more than triple the capacity of the original station.

DRAVO

CORPORATION

DRAVO BUILDING, PITTSBURGH 22, PA.

DRAVO

Engineering constructors of power plants, boiler plants, central stations, compressor stations, water pumping stations. Fabricators and erectors of power piping. Machinery installation. Power and boiler plant equipment.

PITTSBURGH · PHILADELPHIA · CLEVELAND · NEW YORK · DETROIT

"Steel that's properly protected"...that's only one of the things we mean by Service Plus!

BARS · PLATES · FLOOR PLATE
STRUCTURALS · SHEETS
STRIP · REINFORCING BARS
▲
STAINLESS
ALLOY STEELS
ALUMINUM
▲
TOOLS · EQUIPMENT
MACHINERY

● Many of our customers have told us that they were impressed with the excellent condition of our products on delivery. Customers who have visited our warehouses will tell you that factors such as temperature-controlled storage areas, proper packaging and oiling are all important in protecting products made of steel. These protective measures plus handling in the warehouse and in transit deliver Supply Company products to you in the best possible condition.

You will find *"Service Plus"* means other things, too. It means courteous attention from our salesmen, intelligent handling of your requirements, speed when you need it, even technical advice. Giving you *"Service Plus"* . . . is our job.

WHEN YOU DEAL WITH US, YOU GET Service Plus!

UNITED STATES STEEL SUPPLY COMPANY

Warehouses and Sales Offices: BALTIMORE · BOSTON · CHICAGO
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UNITED STATES STEEL

PE 33 12 Ways Better

Available through your distributor or direct from factory stock.

Voltage (KV)	Continuous Current (Amp.)	Interrupting Capacity (RMS Amp.)	Catalogue Number
5	50	1200	PE 335050
7.5	50	1200	PE 337550

1. FULL DROPOUT. Door swings completely open, providing air gap to give unmistakable indication and reduce hazards to personnel and equipment.
2. COMPLETELY HOOKSTICK OPERATED. Door can be opened and closed by *any* hookstick and removed and replaced by hand, *or* door can be opened, closed, removed or replaced with an SS bayonet type or any clamp type hookstick *without being touched by hand.*
3. COMBINATION HOOK RING for use with conventional or clamp type hookstick and socket for bayonet type hookstick.
4. NO EXPOSED LIVE PARTS. PE 33 is encased in high strength wet process porcelain box.
5. DOOR COMPLETELY DEAD WHEN OPEN.
6. HINGE GUIDES AUTOMATICALLY POSITION DOOR for positive engagement. Door is easily replaced even on darkest night.
7. BREAKAGE FROM SHOCK MINIMIZED by strong bakelite hinge bar seated in molded holes in porcelain; hinge bar does not cause radio interference.
8. LESS DOOR BREAKAGE. Extra heavy duty plastic door, ribbed for greater strength and reinforced at ring section.
9. HIGH PRESSURE LINE CONTACTS are of silver plated phosphor bronze.
10. POSITIVE CONDUCTOR CLAMPING ACCESSIBLE FROM EITHER SIDE.
11. EASY RE-FUSING with large knurled silver plated tube cap and long shoulder thumb screw.
12. NEMA-EEI APPROVED MOUNTING BRACKET is strong enough to withstand most severe operating shock. Swivel mounting allows turning cutout to any angle to face lineman.

Southern States Equipment Corp.

HAMPTON GEORGIA

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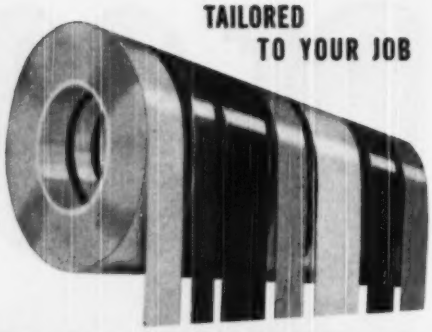
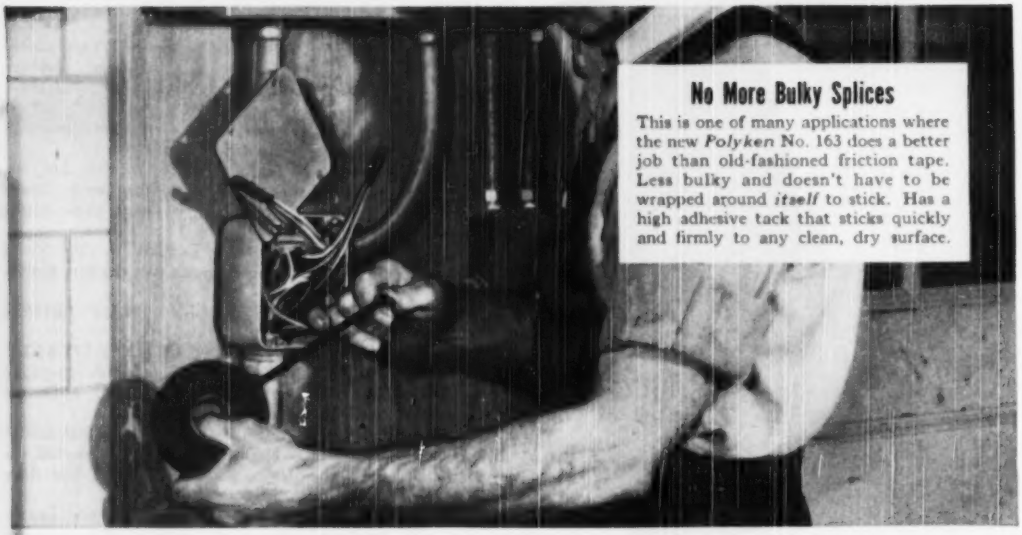
THE NEW

Polyken®

INDUSTRIAL TAPES

TAILORED TO YOUR JOB





No More Bulky Splices

This is one of many applications where the new *Polyken* No. 163 does a better job than old-fashioned friction tape. Less bulky and doesn't have to be wrapped around *itself* to stick. Has a high adhesive tack that sticks quickly and firmly to any clean, dry surface.

After 70 years—an electrical tape that costs less than friction tape

This is the first new thing that's happened in the friction tape field in nearly a century—*Polyken* No. 163. An electrical tape that sticks to any surface as well as to itself. It has higher dielectric strength with less bulk. Forms a better moisture barrier. Doesn't fray. Sticks better and is easier and cleaner to handle.

All this, new *Polyken* No. 163 brings you . . . yet costs less than old-fashioned friction tape! See your Polyken distributor today.

FREE BOOKLET

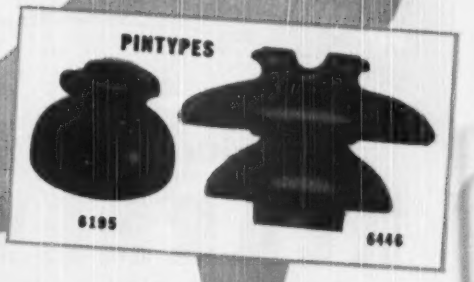
To learn more about revolutionary new tape, *Polyken* No. 163, write for free folder, "Test It Yourself!" Address *Polyken*, Dept. EW-1, 222 W. Adams St., Chicago 6, Ill. Or call your distributor.

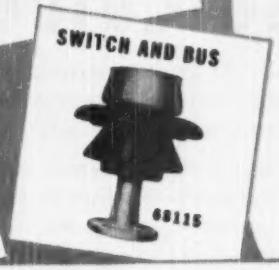
Polyken Industrial Tape, Department of Bauer & Black, Division of The Kendall Company

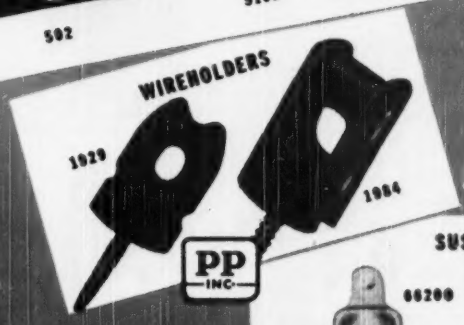
Save Time on Every Job!

Order ALL Your Insulators and Accessories from Porcelain Products Inc.

Buy all your distribution and transmission insulators and accessories from one reliable source. Round out and complete your stocks with PORCELAIN PRODUCTS' complete line of performance-tested wet process porcelain insulators, and save time on both maintenance and new construction. Ask us to send a representative to discuss your needs. Catalog and price information sent on request.







PP INC.

Porcelain Products, Inc.

PARKERSBURG, WEST VIRGINIA

EXPORT REPRESENTATIVE:

ISOLATE SERVICE ENTRANCE FAULTS

PROTECT TRANSFORMERS FROM SECONDARY FAULTS

MAKE BANKING OF SECONDARIES POSSIBLE

with the

KEARNEY Secondary Fuse Cutout

Here is the most efficient inexpensive way possible to protect expensive transformers and other equipment from secondary faults.

Sturdily constructed of non-metallic material this cutout transfers current from the secondary to the top directly through the link itself with no intermediate connection or transfers.

Designed without nuts or bolts to tighten—refusing and installing is a matter of seconds.

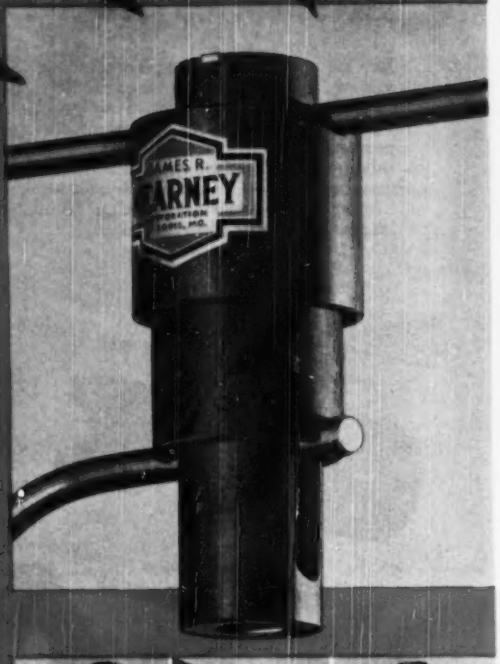
Write for more detailed information.

JAMES R. KEARNEY CORPORATION

4224-42 Clayton Ave., St. Louis 10, Missouri

Canadian Plant: Guelph, Ontario

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO.



STEP ONE | STEP TWO | STEP THREE

STEP ONE: Drop the fuse link in the top opening of the cutout. Then, compress the lower shell and insert the top wire in the hole provided in the link.

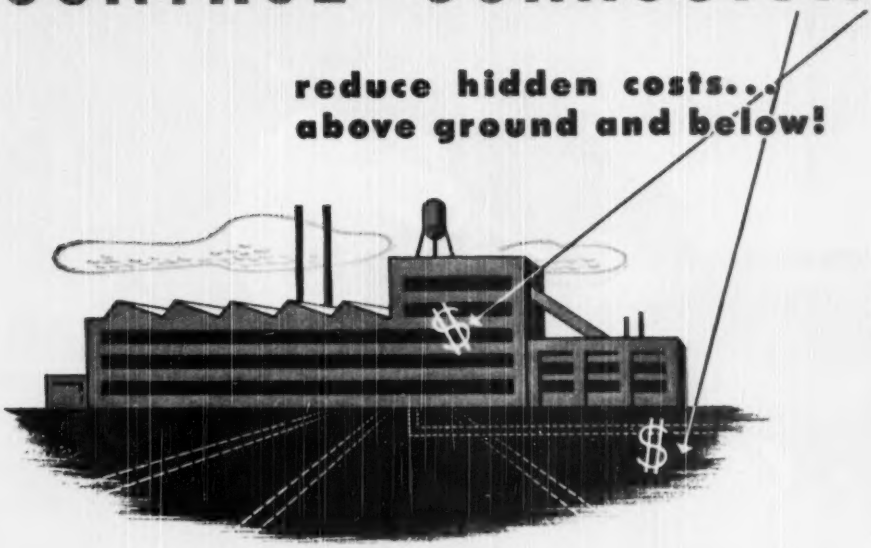
STEP TWO: Compress top shell and twist to the right or left so that it stays in the open position.

STEP THREE: Hang the cutout on the secondary, release top shell by twisting to make the final pressure contact with the secondary.

BETTER CONSTRUCTION *Safer* MAINTENANCE

CONTROL CORROSION!...

reduce hidden costs... above ground and below!



Today's corrosion rate is alarmingly high! Unless you have adequate control, your business is incurring unnecessary losses. Either *directly*—due to high maintenance costs and replacement of corroded equipment; or *indirectly*—through losses due to idle equipment, loss of product and plant efficiency.

EBASCO corrosion control consulting services are applicable to:

1. All buried or submerged metallic structures—oil, water, gas pipelines and cables—both cross country and urban.
2. Manufacturing, processing and power plants—either on existing facilities or proposed new structures.

These services include a preliminary survey to determine causes of corrosion; recommendations for corrective measures; design and installation of corrosion control methods; and development of a permanent corrosion control program.

EBASCO can help you develop *your own* corrosion control program.

EBASCO specialists not only can help you spot and remedy specific corrosion troubles—but can train your own personnel in setting up *your own corrosion control program*—so you can continue to keep down these "hidden" costs.

Remember... corrosion control is something you can't afford to put off. Call in EBASCO specialists—find out what they can do to help you protect your structures now, and for years to come.

Write for the booklet *"The Inside Story of Outside Help"* describing the many EBASCO services available to you. Ebasco Services Incorporated, Dept. M, Two Rector Street, New York 6, N. Y.

ENGINEERS · CONSTRUCTORS · BUSINESS CONSULTANTS

EBASCO

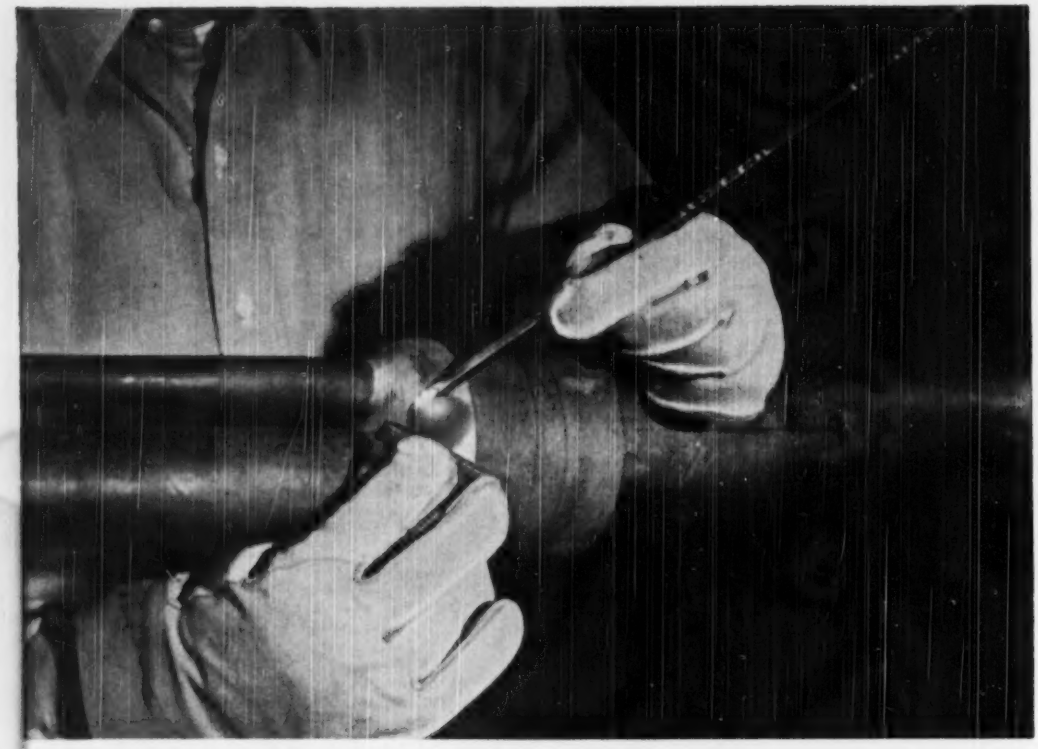
Appraisal	Insurance & Pensions
Budget	Office Modernization
Business Studies	Purchasing
Consulting Engineering	Rates & Pricing
Design & Construction	Research
Financial	Sales & Marketing
Industrial Relations	Systems & Methods
Inspection & Expediting	Taxes
	Traffic

EBASCO SERVICES

INCORPORATED

NEW YORK · CHICAGO · WASHINGTON, D.C.

Ebasco Teamwork gets things done anywhere in the world



He seals out trouble...

TO KEEP THE COST OF YOUR TELEPHONE SERVICE DOWN

To make cable joints tight and strong, splicers formerly used lots of solder. Then, Bell Telephone Laboratories developed a new technique for making *better* joints with much less solder. This saves one million pounds of solder a year — helps keep the price of your telephone service low.

Two kinds of solder are now used. One makes the splice strong; the other seals it. First, the splicer builds up a joint with a solder of lead and tin, which flows easily under his wiping cloth. To seal the joint, he applies a light coating of low-melting-point solder, composed of lead, tin and bismuth. On contact with the still hot joint, it flows into and seals every pore.

Cable-sealing solder is only one of 30 low-melting-point alloys which Bell metallurgists have developed for special uses — in fuse wires, for example, and in the solder connecting hair-like wires to piezoelectric crystals for electric wave filters.

Continuing research with a substance seemingly as commonplace as solder demonstrates again how Bell scientists help keep your telephone service the world's best.

BELL TELEPHONE LABORATORIES

• WORKING CONTINUALLY TO KEEP YOUR TELEPHONE SERVICE BIG IN VALUE AND LOW IN COST

10 REASONS WHY

G & W Capnut Terminal Potheads

GIVE YOU

TROUBLE-FREE SERVICE

1 Interchangeable aerial lug clamps through thin wall hoodnut to permanently lock assembly against vibration. Electrical contact is made on both sides of 'V' of threads.

2 "Resistoyl" gasket hermetically seals top of porcelain. Gasket and threaded connector are covered by capnut.

3 Connector ears bear on porcelain shoulders, and slots in porcelain engage connector fins to hold assembly while capnut is screwed on.

4 Porcelain is designed with large bore and thick walls to provide extra safety factor.

5 Bodies are properly sized for best electrical characteristics and easy installation without injury to cable.

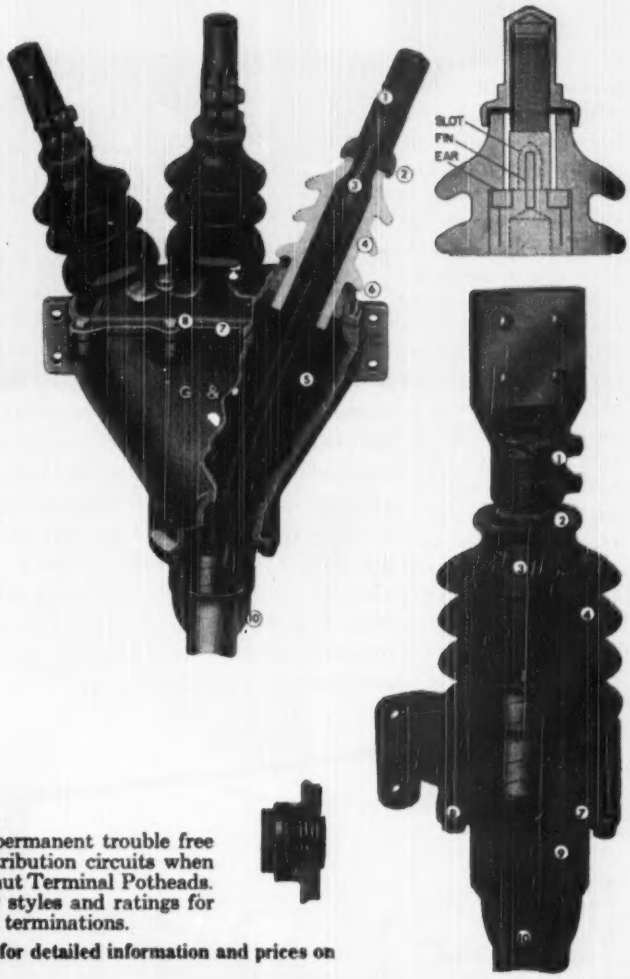
6 "Resistoyl" gasket under bottom petticoat of porcelain has an extension into body opening to prevent it from squeezing out when compressed. Cement holds gasket in compression for permanent tightness.

7 Lid and body flanges are machined to provide smooth parallel gasket surfaces for permanent tightness.

8 Lid flange is extra thick to prevent bowing when capscrews are tightened.

9 Gasket flanged pipe plugs provide permanent seal for filling holes.

10 Wiping sleeve (or optional stuffing box) cable entrance provides permanent seal at bottom of pothead.



Add these features and you get permanent trouble free operation of your high voltage distribution circuits when cables are terminated in G & W Capnut Terminal Potheads.

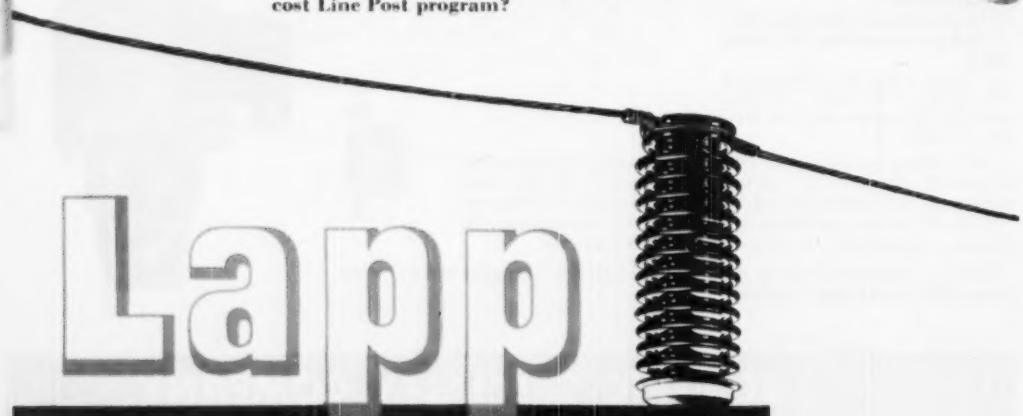
G & W makes potheads in many styles and ratings for single and multiple conductor cable terminations.

Ask our representatives or write us for detailed information and prices on your cable terminating requirements.

G & W ELECTRIC SPECIALTY COMPANY.
7780 DANTE AVENUE • CHICAGO 19, ILLINOIS, U.S.A.
Representatives in principal cities. In Canada, Powerlite Devices, Ltd., Toronto

IF YOU HAD TO STACK 'EM ALL IN YOUR OFFICE...

Do you think that your system is one which "doesn't have trouble with high-voltage pin-type insulators?" If so, it might be worth a good many thousands of dollars per year to your company to have you take a real good look at your maintenance records. The number of pin-type insulators which have to be replaced every year—and the man-hours required to replace them—add up to an annual bill probably a great deal larger than you suspect. And it's a bill that could be cut to a tiny fraction of its present size by standardizing on Lapp Line Posts. There's a 19-year service record back of Lapp Line Posts to back up this fact. Isn't it time for *your* company to undertake the high-preformance low-cost Line Post program?

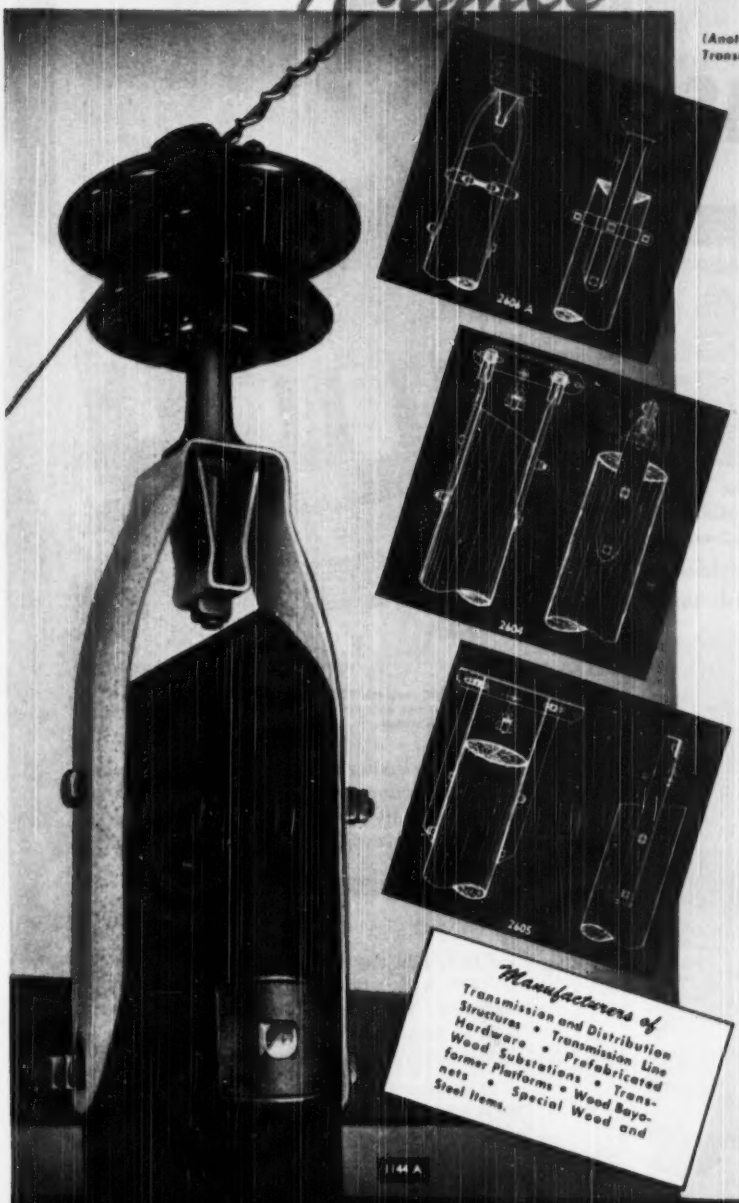


Lapp

LAPP INSULATOR COMPANY INC., LEROY, NEW YORK

Form Fitting Hughes RIDGE IRONS

(Another HUGHES development for better Transmission and Distribution Structures)



In cooperation with transmission engineers in many utilities, Hughes Bros. has designed a full line of standard Ridge Irons, four of which are shown at the left. They are simple and strong in design, carrying all loads that can be carried by standard insulator pins, and adjustable to variations in pole sizes. Ridge Irons for shield wires do not require threading the wire through, as it can be laid in by removing one bolt. The shield wire cannot drop on the conductor in the event of clamp or pin failure. If you have special requirements for Ridge Irons, write to our Engineering Department about them. Many other designs available.

Manufacturers of
Transmission and Distribution Structures • Transmission Line Hardware • Prefabricated Wood Substations • Transformer Platforms • Wood Bayonets • Special Wood and Steel Items.

HUGHES BROTHERS *developed and pioneered "X-Braced" construction,* worked out the structural theory, and confirmed it by full-sized tests. The results: Thoroughly reliable transmission systems, and savings of millions of dollars for the electric utility industry.

WHEN IT'S HUGHES . . . *It's Tailored* TO YOUR NEEDS

HUGHES BROTHERS SEWARD NEBRASKA

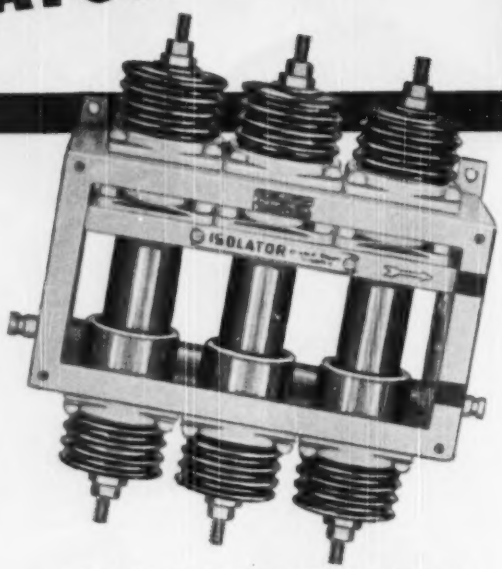
FOUNDED - 1921 INCORPORATED

"HUGHES" TRANSMISSION & DISTRIBUTION WOOD METAL MATERIAL MEN'S

THE ISOLATOR STORY

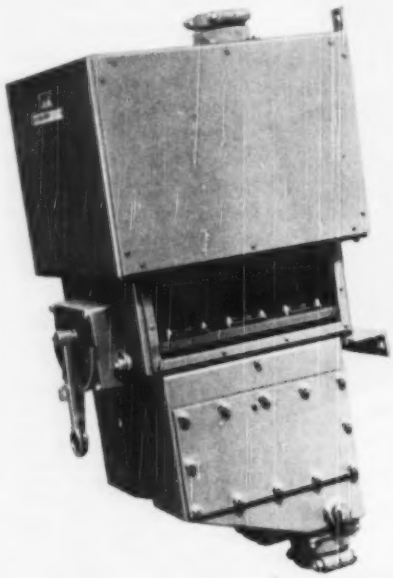
The ISOLATOR story is replete with many interesting facts. These facts show how Power and Industrial companies have saved SPACE, MATERIALS, and INSTALLATION LABOR, and also helped to PREVENT ACCIDENTS by use of this device.

The unique construction of the ISOLATOR, with its telescoping parts, accomplishes all these and still maintains all accepted engineering standards.



3 P.D.T. 400 ampere 7500 volt ISOLATOR with shaft extended on either side for attaching direct or remote control operating mechanism.

If you are seeking the Most Modern Method of disconnecting high voltage lines and circuits, especially in vaults, cubicles and other enclosures, investigate the ISOLATOR.



3 P.D.T. 600 ampere 5000 volt Cable ISOLATOR with upper connections in metal enclosure. Several of these assemblies were built to meet special requirements of a large industrial company.

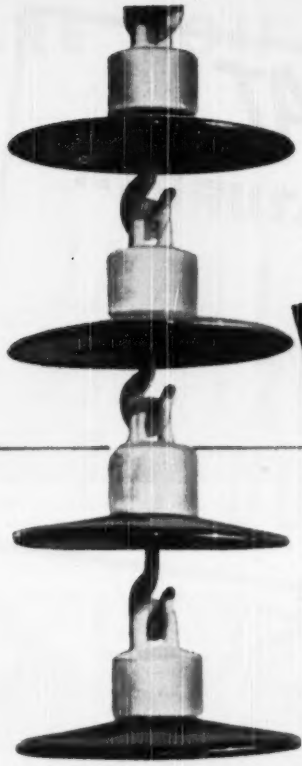
This equipment illustrates how standard ISOLATOR parts may by slight modification be made suitable for unusual conditions.

Our bulletin 140 contains a lot of information on the ISOLATOR. It is yours for the asking.

THREE

ELECTRICAL ENGINEERS EQUIPMENT CO.

MELROSE PARK, ILLINOIS

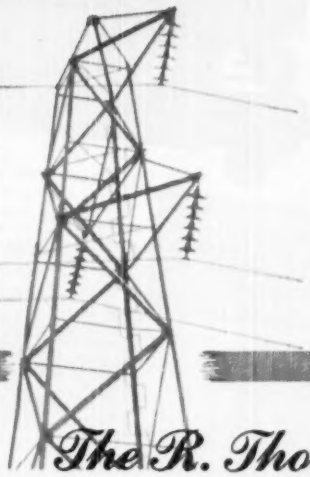


1907

THOMAS was FIRST with the CAP-AND-PIN Suspension Insulator

1950

THOMAS is STILL the Standard of Comparison



● In 1907, Thomas pioneering resulted in the first Cap-and-Pin Insulator. The first installation, 10,000 units, was made that year in Central California. After 43 years of continuous service, these insulators are still operating satisfactorily.

Today, Thomas suspension insulators are accepted as the standard of quality throughout the Industry. Proper designing, precision manufacturing . . . and PROOF of PERFORMANCE make them the best choice for the most difficult insulation problems. Why gamble?

Despite these unusual times, when quality and skilled workmanship could be sacrificed, you can specify Thomas Insulators with full confidence that quality and value cannot be surpassed.

The R. Thomas and Sons Co.

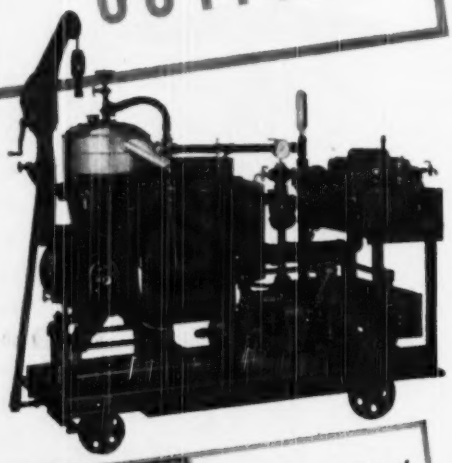
LISBON, OHIO
NEW YORK CHICAGO

Sales Representatives: Paul Berry, *Oklahoma City* • Ken H. Best, *Seattle* • Butler & Land, *Dallas* • John A. Clark Electric Co., *Minneapolis* • R. E. Cunningham & Son, *Los Angeles* • Electric Supply Co., *Albuquerque* • Engineer Sales Corp., *St. Petersburg* • R. F. Hamilton & Associates, *Denver* • Geo. E. Honn Co., *San Francisco* • Leiser & Co., *Philadelphia* • Lynn Elliott Co., *Houston* • John G. Pettyjohn Co., *Knoxville* • Redmond Supply Co., *Phoenix* • J. F. Schaefer & Co., *Kansas City* • R. J. Sullivan & Co., *Boston* • Triangle Electric Supply Co., *El Paso* • Joe Williams, *Little Rock* • *Representatives in other principal cities.*

PURIFICATION AT SAFELY LOW TEMPERATURES..

DE LAVAL PORTABLE OUTFIT

De Laval purification is accomplished at safely low temperatures. This is an important advantage. The solubility of oil increases with the temperature. If oil is heated considerably above 90 deg. F before water is removed, some free water will be driven into solution. The result would be that while a relatively high dielectric test may be obtained immediately after purification at the higher temperature, up to 50 per cent of the improvement may be lost when the oil is cooled to normal temperature, releasing the dissolved water again from solution.



ADVANTAGES OF DE LAVAL INSULATING OIL PURIFIERS

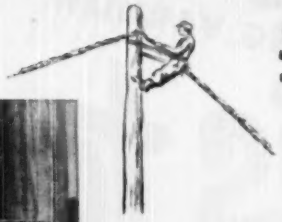
- Constant high purifying efficiency—no shutdowns for cleaning or for removal of parts during run
- Dehydrates at a single pass—no re-running
- Safest—continuous discharge of water prevents re-condensation of the insulating oil
- Higher daily capacity of purifier saves maintenance costs
- More economical to operate
- Removes free water without aid of filter press; press used only to remove entrained carbon
- Heater cannot carbonize the oil
- Low temperature purification; high dielectric value of oil maintained longer

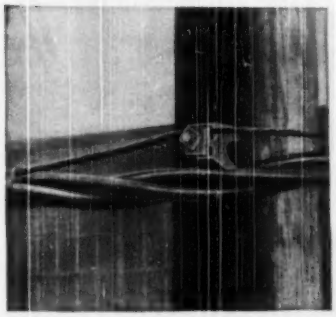
DE LAVAL

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

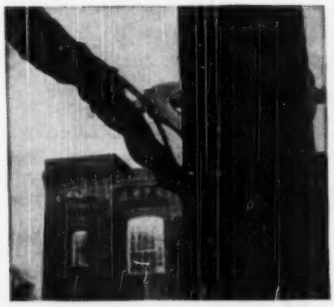
INSULATING OIL PURIFIERS

ARE YOU USING THE RIGHT *SUSPENSION CLAMP?*





PA198—a single bolt, light duty Clamp, showing messenger placed above through bolt.



PA198—messenger below through bolt. Body casting is tapped to permit through bolt to serve adequately as the clamping bolt as well.

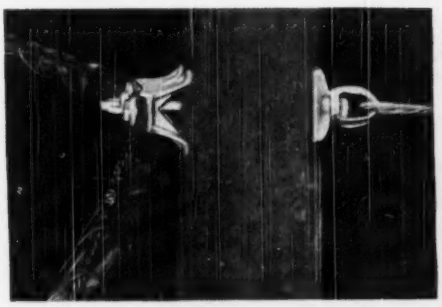
Aerial Cable Suspension Clamps

are designed for simplified installation, superior performance, and long service life.

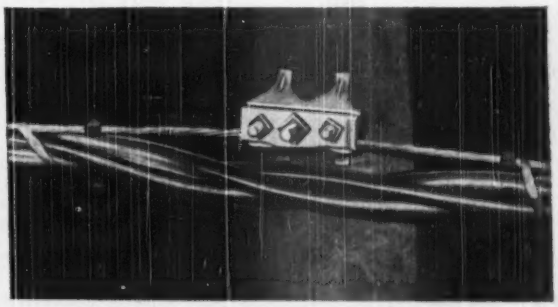
Illustrated here are two new MIF Suspension Clamps designed especially for use with self-supporting type aerial cable. Both Clamps hold the cable well clear of the pole and provide unusual stability. Messenger may be placed either above or below through bolt. Castings are malleable iron, hot dip galvanized.

As a result of over 20 years' experience manufacturing Suspension Clamps for all types of aerial cable, MIF offers a complete line of Suspension Clamps for every application. All MIF Suspension Clamps combine four functions in one fitting: clamp, support, spacer and pole plate. Write for descriptive literature on Suspension Clamps, Guy Clamps, Guy Hooks, Washers and many other MIF pole hardware specialties.

MALLEABLE IRON FITTINGS COMPANY
Pole Hardware Div., Branford, Conn.
N. Y. Office: 30 Church St.
Canadian Mfr. & Dist.: LINE & CABLE ACCESSORIES, Ltd., TORONTO



PA192A—Note distance at which cable is held from pole. Ends of grooves are belled to permit turns up to included angle of 90°.



PA192A—with messenger below through bolt, showing small amount of tape cut back required on either side of Clamp.

Representatives: WM. J. COTTRELL CO., Portland, Ore. • JAMES H. DREW CORP., Indianapolis, Ind. • INDUSTRIAL ENGINEERING & EQUIPMENT CORP., Los Angeles, Cal. • MINTEER & JOSLER, Chicago, Ill. • E. A. THORNWELL, INC., Atlanta, Ga. • J. P. VOIGHT, Summerville, S. C. • WALTHAM, DE WITT & KRUSI, San Francisco, Cal. • L. R. WARD CO., Dallas, Tex. • WILLIAMS SALES AGENCY, Fort Myers, Fla. • O. C. WITTE CO., Detroit, Mich.

USERS SAY G.E.'S 9574 ALL-PURPOSE* INSULATING VARNISH "is tops!"

J. L. Hughes

How do users like General Electric's new all-purpose insulating varnish G-E 9574?

Here's a statement from J. L. Hughes, owner of the J. L. Hughes Electric Company, Columbus, Ohio.

> *"We have found from test and practical experience that General Electric general-purpose varnish 9574 is tops for our work."*

Mr. Hughes knows what he is talking about. He has been in the business of motor repair and rewinding in Columbus for thirty-three years.

YES, G-E 9574 OFFERS YOU

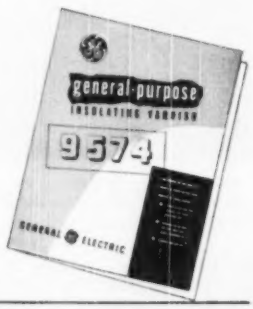
One varnish you can depend on for ALL* jobs.

A Combination of electrical, chemical and mechanical properties formerly found only in special-purpose varnishes.

Easier Handling: Low baking temperature; deep penetration; simple thinning with petroleum spirits.

**G-E 9574 gives excellent results on all types of coils except extra-high-speed armatures. It is one of G. E.'s complete line of electrical insulating materials, including adhesives, wedges, cements, compounds, cords and twines, sleeving, wire enamels, mica, papers and fibers, permafils, tapes, tubing, varnished cloths, and varnishes.*

SEND FOR BULLETIN! If you haven't yet tried G-E 9574, get in touch with your local G-E Distributor, or write for our new bulletin to Section K1, Chemical Department, General Electric Company, Pittsfield, Massachusetts.

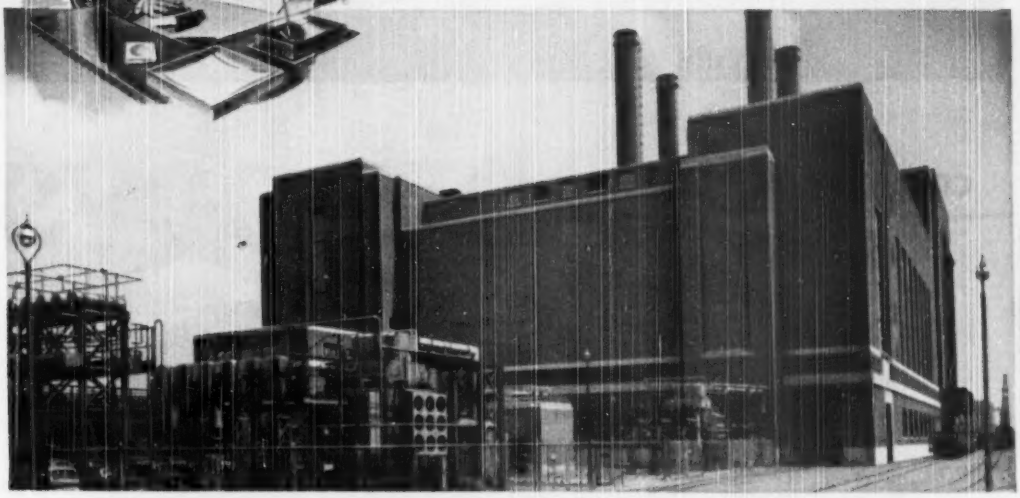


You can put your confidence in

GENERAL ELECTRIC

CT560-K1

"My bet's on Bituminous-



—the kind that is mined on the B&O!"

Take a tip from executives who think in terms of fuel economy and dependability of supply. These men design their plants for the efficient coals mined in B&O territory.

These coals, available in wide variety for all needs, lend themselves to mechanized, low-cost mining. As they are located close to America's industrial heart, transportation costs are moderate. And because their sources are *known* and *definite*, they can be depended upon —*even during wartime*—for centuries to come.

Backing its faith in Bituminous, the B&O has made large capital investments in its properties. The result will be even more efficient service for the Bituminous industry and its customers.

Ask Our Man!

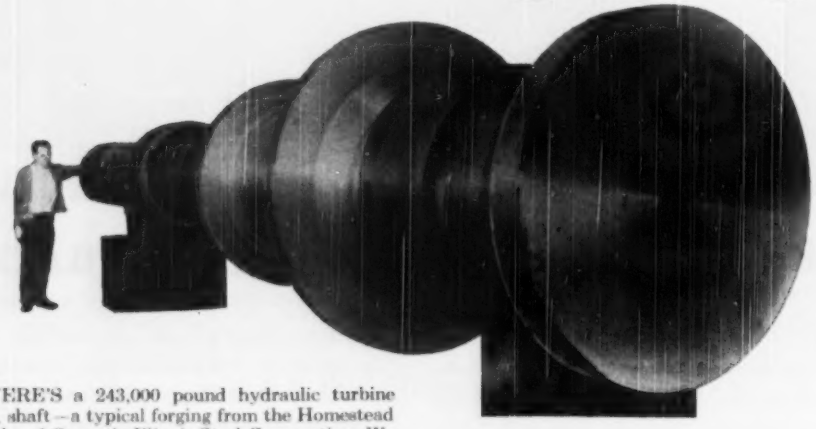
BITUMINOUS COALS FOR EVERY PURPOSE

from modern mines like this→

BALTIMORE & OHIO RAILROAD

Constantly *doing things*—better!

COME TO US FOR THE big boys



HERE'S a 243,000 pound hydraulic turbine shaft—a typical forging from the Homestead Works of Carnegie-Illinois Steel Corporation. We make them even bigger than this.

From start to finish, the manufacture of top-quality heavy commercial forgings requires the most precise metallurgical control, the most modern machinery, the most skilled workmen—workmen who are *experienced* in this most demanding phase of steel production. Carnegie-Illinois has all three.

We make our own steel, carbon or alloy, open hearth or electric furnace, in a wide range of ingot sizes up to the largest required for massive forgings. The ingot size for each job is carefully selected to assure thorough working to obtain the physical properties and structure most desirable for the ultimate application. We can heat treat forgings in sizes ranging up to the maximum currently being purchased. Our up-to-date machine shop contains all necessary turning, boring and planing equipment.

Whatever your needs . . . generator shafts . . . bridge pins . . . drop hammer anvil bases . . . reduction gears . . . hollow forgings . . . take advantage of our unbeatable combination of men and equipment. It's your best assurance of quality forgings, produced exactly as you want them. Get in touch with us today for a complete outline of our services.

CARNEGIE-ILLINOIS STEEL CORPORATION, PITTSBURGH · COLUMBIA STEEL COMPANY, SAN FRANCISCO
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM · UNITED STATES STEEL EXPORT COMPANY, NEW YORK

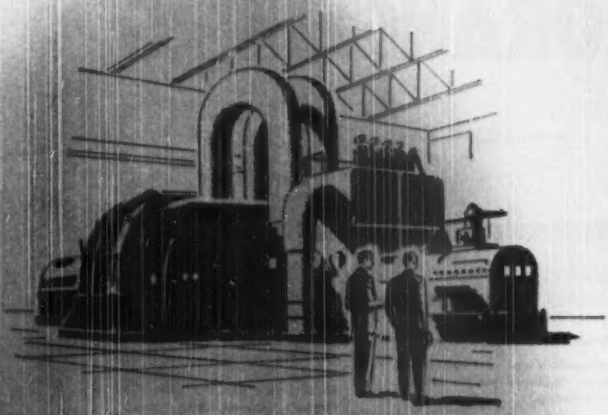
USS Commercial Forgings

0-1555

UNITED STATES STEEL

Today it's Roebling!

There are more than 60 standard types in Roebling's line of electrical wires and cables. From copper conductors to protective jackets, they are made entirely in Roebling plants. Special techniques and the most modern, precision machines assure quality products, unsurpassed for service and economy.



for V. C. Cable with superior heat resistance

WHEREVER CIRCUITS heat up, you'll get new measures of dependability . . . save both time and money . . . with Roebling Varnished Cambric Cable! It has extreme resistance to heat and is your A-1 specification for leads for generators, transformers, motors and oil switches.

Roebling Varnished Cambric Cable is made in single and multiple conductor types—single, from 2,000,000 C. M. to No. 14 A.W.G.—multiple from 500,000 to No. 14 A.W.G. Both constructions are adapted for use up to 17,000 volts between phases for unshielded multiple conductor . . . up to 21,000 volts between phases for single conductor and shielded cables on ungrounded neutral systems . . . up to 28,000 volts between phases for single conductor and shielded cables on grounded neutral systems.

Write for complete information, or call on your Roebling Distributor for help in choosing the best cables for your requirements. John A. Roebling's Sons Company, Trenton 2, New Jersey.

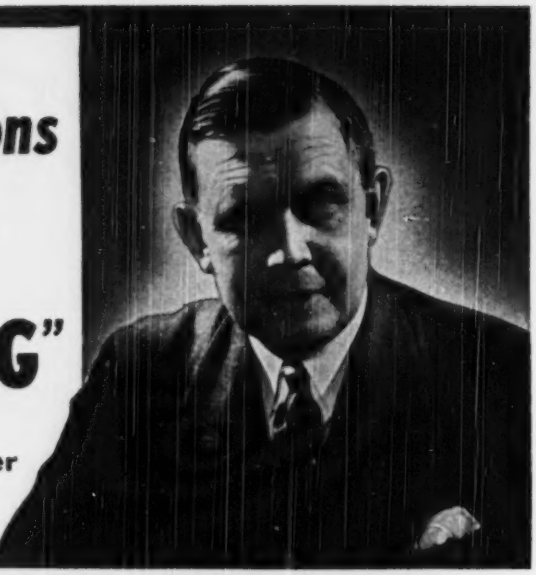
ROEBLING A CENTURY OF CONFIDENCE

Atlanta, 934 Avon Ave. ★ *Boston*, 51 Sleeper St. ★ *Chicago*, 5525 W. Roosevelt Road ★ *Cincinnati*, 3253 Fredonia Ave. ★ *Cleveland*, 701 St. Clair Ave., N. E. ★ *Denver*, 4801 Jackson St. ★ *Houston*, 6216 Navigation Blvd. ★ *Los Angeles*, 216 S. Alameda St. ★ *New York*, 19 Rector St. ★ *Philadelphia*, 12 S. Twelfth St. ★ *Portland*, 1032 N. W. 14th Ave. ★ *San Francisco*, 1740 Seventeenth St. ★ *Seattle*, 900 First Ave. S.

JOHN A. ROEBLING'S SONS COMPANY, TRENTON 2, NEW JERSEY

"Here are 8 Reasons why I specify ORANGEBURG"

— says the Utility Engineer



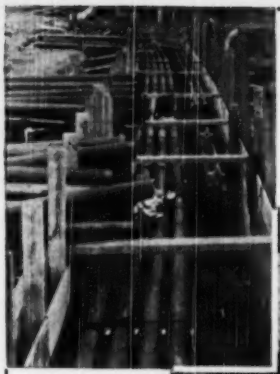
The man in the picture symbolizes the many utility engineers who always specify Orangeburg® Conduit. And here are eight of the numerous reasons why he feels that way.

- Will not corrode. Lasts indefinitely.
- Impermeable wall and tight joints prevent corrosive ground waters from entering.
- Lays faster and at lower cost than any other type of conduit.
- Low coefficient of friction keeps pulling tensions on cable to minimum.
- Protects cable sheath from abrasion when pulled in—also from wear during cable movement due to alternate expansion and contraction with changing loads.
- Resists acids, alkalis, grease, oil.
- Light, easy to handle and tool on the job.
- Tough, resilient—will not crack or break when properly handled.

Cable HEALTH Is Community WEALTH

Every industry and business prospers, every home and institution benefits from the uninterrupted flow of power through "healthy" cables. The utility engineer knows this well. Leading public utilities and municipalities therefore use Orangeburg Conduit to provide a time-defying raceway for the permanent protection of electrical services underground. Orangeburg has successfully served the electrical industry for 57 years.

And Orangeburg saves money for these users, too . . . by faster hauling, handling, tooling and laying. Costly delays on the job are further prevented by Orangeburg's complete line of bends, angle couplings, bend sections, union connections, bell ends and other standard fittings. Orangeburg Manufacturing Co., Inc., Orangeburg, N. Y.



ORANGEBURG STANDARD

. . . installed *with* concrete encasement. The preferred conduit for banks of three or more ducts.

ORANGEBURG NOCRETE

. . . installed *without* concrete encasement. Its extra heavy wall makes NOCRETE practical for many single or double duct runs.

ORANGEBURG FIBRE CONDUIT

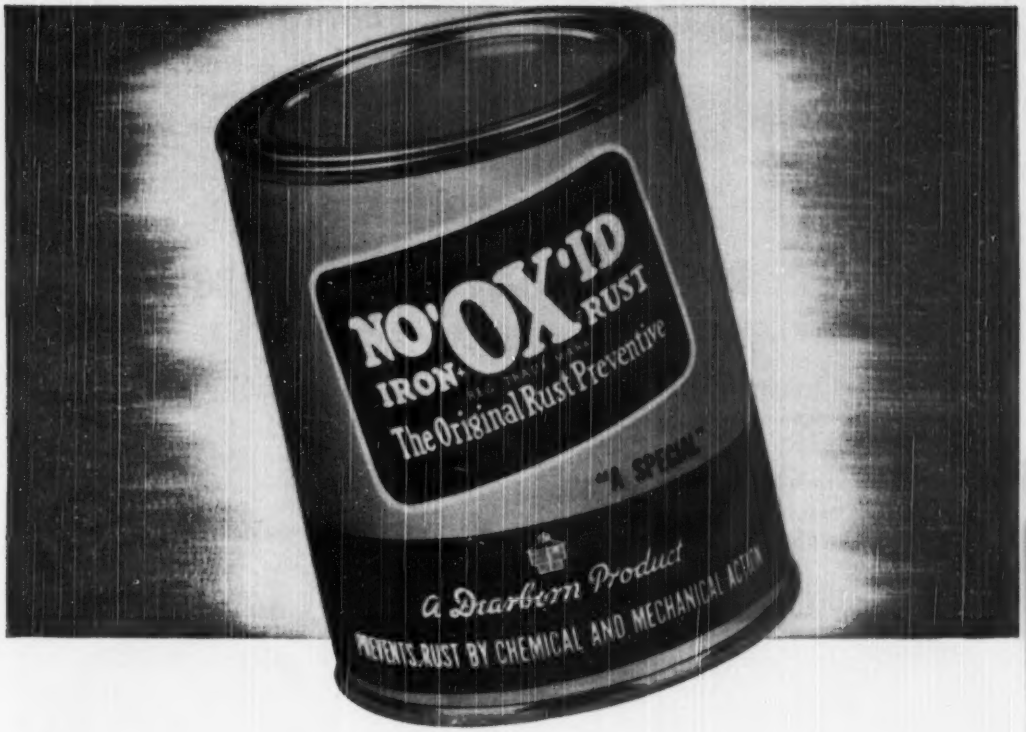
STANDARD Installed with Concrete

NOCRETE Installed without Concrete

GENERAL ELECTRIC SUPPLY CORPORATION

DISTRIBUTORS, ORANGEBURG FIBRE CONDUIT

Graybar ELECTRIC COMPANY



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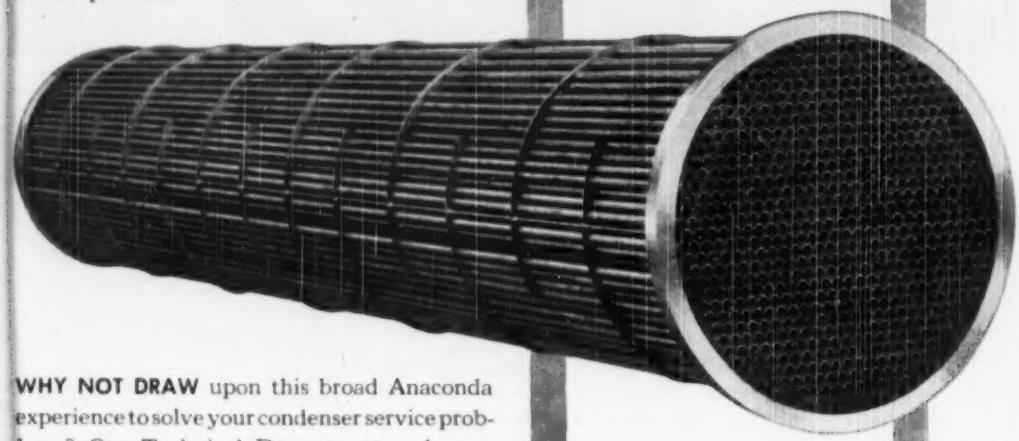

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UPPER PHOTO shows Adams two-shell, single stage aftercooler designed to control temperature of compressed air and to condense water and oil vapors present. The condensate is removed by a separator. Built by R. P. Adams Company, Inc., Buffalo, N. Y.

LOWER PHOTO shows tube bundle for aftercooler. ANACONDA Arsenical Admiralty Tubes, Muntz Metal Tube Sheets and Brass Baffles.

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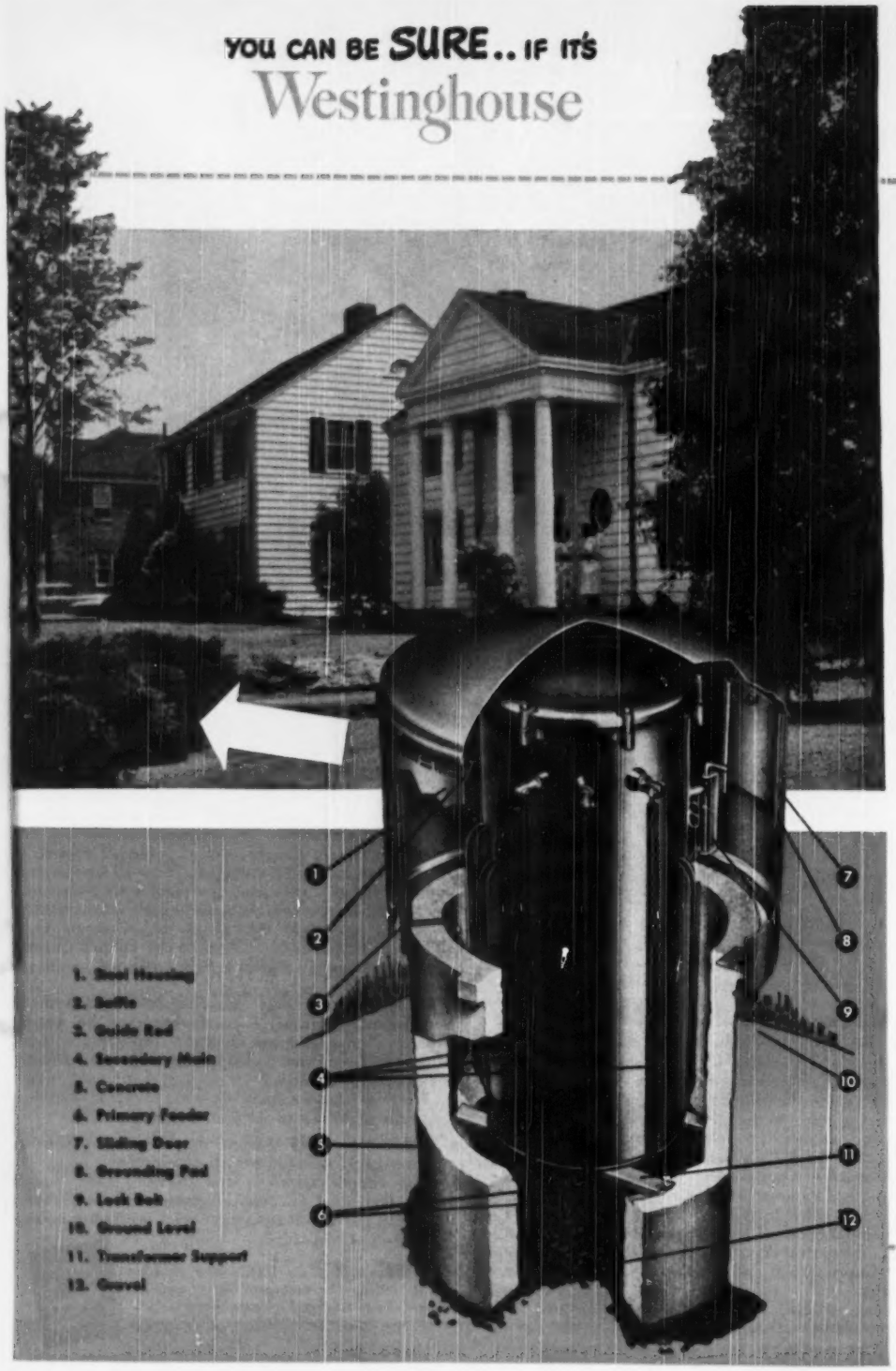

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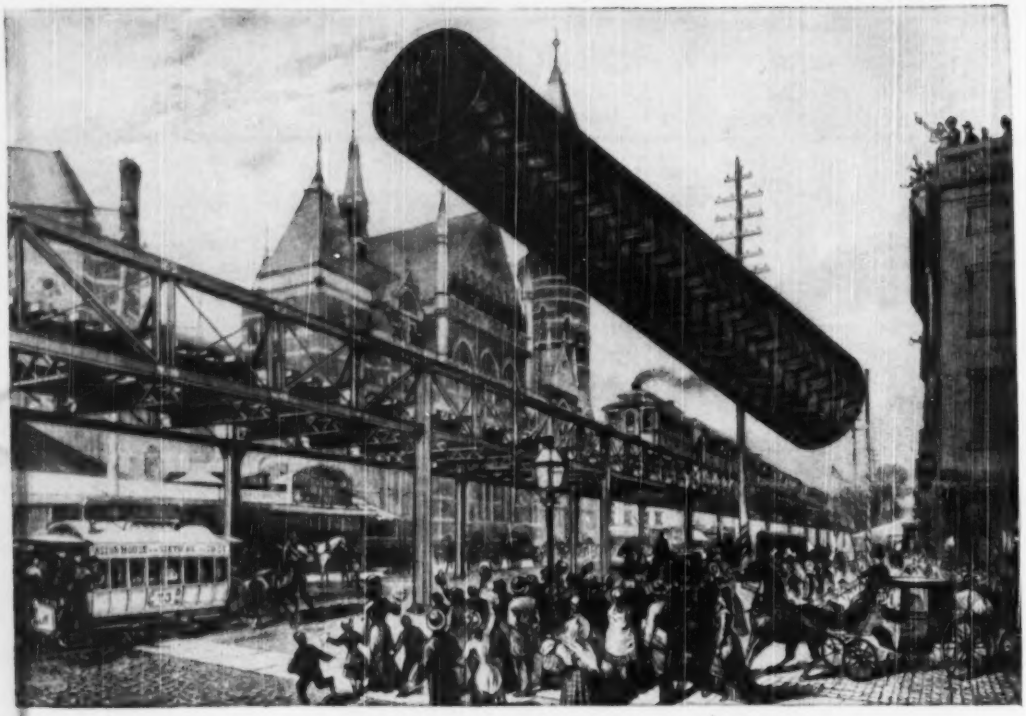
Heart of the unit is the Westinghouse Distribution Transformer ("CSP"® or Conventional). This design handles residential services using transformers 50 kva and below. For further information, contact your Westinghouse representative or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70552



Segment of Kerite cable after 50 years' service on the New York Sixth Avenue "el."

Returned to stock after 50 years' service

IN 1889, a large amount of Kerite 600-volt telegraph cable was installed on the Sixth Avenue "el" in New York City. It was 19-conductor cable; all conductors were individually insulated No. 14 wire. The outer mechanical protection was provided by cotton braid, which was well preserved by painting.

Fifty years later, when the "el" was torn down, the Kerite cable was removed. The Kerite insulation was found to be live and sturdy. Electrical tests found the average breakdown voltage to ground of the 600-volt Kerite insulation on the 19 conductors to be 31.5 kv.

Most of the cable was returned to stock for future use!

Modern Kerite cable for similar service uses asbestos or glass braid which will not rot and which requires no maintenance. But the insulation itself is still made with the same Kerite that produced the insulation described here.

Kerite insulated wire and cable is available in many forms and for many purposes—low or high voltage, indoor, outdoor, aerial or submarine. Ask any Kerite user about its stamina and low cost per year. *The Kerite Company, 30 Church Street, New York 7, N. Y.*

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KERITE CABLE

We Need Another OWU

THE ELECTRIC UTILITIES are deeply concerned over the outlook for government controls. The situation arises not so much from the controls themselves as from the agency designated for screening power equipment. The Department of Interior may get the job.

Authoritative sources state that the President intends to let the Commerce Department allocate scarce materials and to give the screening of claims for power equipment to Interior. This means that the NSRB will remain a planning agency only under the current program.

Since Interior is in outright competition with the electric utilities, it is difficult to envisage its having a completely unbiased approach in this important activity. Certainly it would be difficult to develop the mutual cooperation and team work that would be essential. It is not suggested that the Department of Interior would openly permit unfair treatment of investor-owned companies. But it is entirely possible that the staff might show partiality for public power groups.

If such a danger exists, where can the utilities go to find the impartial treatment they received in the last war? The first choice would be an entirely separate organization with the most able representation to be found in the industry. The second choice might be the Commerce Department. The Federal Power Commission has been suggested. But here we have an agency with regulating power exercising a substantial amount of control over the power industry. It would be unwise to mix up this regulating power with temporary controls.

There is still some doubt about the immediate need for control over steel, aluminum, and copper. Obviously they are in short supply. But according to some estimates a maximum of not more than 10% of the steel output will be required for military purposes under the current program. The case for aluminum and copper is more serious. But should the military situation stabilize in the next few weeks permanent governmentally enforced controls may be premature.

If controls are decided upon, it is important to assure hearty cooperation from the electrical industry. We believe that an independent agency is the only proper way to achieve this result. This plan would provide governmental agencies and private industry equal consideration.

Should a temporary placement of this screening function go to Interior, the industry must give full cooperation as a patriotic duty. But the only permanent solution is another Office of War Utilities with much the same kind of staff that it had in World War II.

TV—An Advertising Medium

THE ELECTRIC UTILITY industry is the only industry that has a chance to realize a two-fold profit directly from the television industry. Obviously, these benefits can accrue from use of television for advertising and as a revenue builder. This observation was recently made by Robert S. Peare, vice president of General Electric Co, in a speech in which he urged utilities to put television to work in their public relations and advertising programs.

Commenting on the great importance of the television industry, Peare predicted that by 1954 an estimated 34 million sets will be consuming approximately 8½ billion kwhr annually. He suggested the possibility that as a rule of thumb gage of expenditures the industry put back into TV as an advertising medium the amount of money that it takes in as revenue from the transmitters and receivers over the next five years. As Peare suggested, this amount, which might reach $4 per customer per year, is well on the high side of anything that would be expended for advertising and public relations. It does illustrate, however, the great possibilities of the television industry as a revenue producer that can be advantageously exploited in many different ways for the benefit of the power companies. A number of utilities, such as Philadelphia Electric Co and Consolidated Edison Co, already have begun using television in their promotion programs.

Certainly this industry should be the leader in all communities in promoting this great new medium using sight, sound and motion to put across ideas. We believe that all the utilities should not only use the television facilities available to them but that they should actively promote this industry in every community which they serve. In this way they can avail themselves of this advertising medium and revenue producer and open up to their customers an effective means of intercommunication.

Cycle Efficiency on Plateau

FUEL CONSUMPTION per kilowatthour dropped rather sharply to 1.20 lb of coal or equivalent in 1949. The improvement was due largely to the increase in new and highly-efficient units added since the war. If it were possible to supplant all old and relatively inefficient generating facilities, the figure should soon drop to 1 lb. In fact, it will not be surprising if the industry average is that good 10 or 12 years hence. The best plants are already some 20% ahead of that prospective average.

What are the prospects of grinding out kilowatthours in the best plants for 8,500 or even 7,500 Btu per kwhr? The answer is not derivable from current operations, but there is a rising crop of proposals to combine cycles in an effort to dodge the inherent limits of the steam cycle. The mercury-steam cycle was one of the early manifestations of such thinking. Performance potentiality is apparently approaching a plateau. There is no better index of this than the enlivened imagination of several individuals who are explaining and analyzing various possibilities.

The gas turbine in conjunction with the conventional steam turbine cycle is the goal of some of this projective thinking. Why not use each for the bracket in which it offers superiority? For example, the compressor attached to the gas unit could deliver its output air at 100 or maybe 150 psi to a boiler modified in design to accommodate such pressure in its combustion chamber. The boiler walls and tubes would extract the high temperature heat and the remaining heat content (at the same gas pressure) would pass to the turbine at temperatures the blading could take safely.

Another proposal, farther from probable reality, involves viewing the gas turbine as dominantly a peaking unit. So why tax its promisingly good thermal efficiency by using up half or more of its output to drive the necessary compressor? Why not accumulate the required air over night even if the compressor is driven by power from steam or hydro? The problem is to devise a container for a day's need of huge volumes of combustion air for the gas turbine.

Still another dream aims at eliminating from the steam cycle the heavy discard of heat that goes to the river, lake, or ocean in the condensing water. The suggestion is to compress the exhaust steam as it emerges from the turbine so that it can be returned to the boiler as water with retention of its heat of vaporization.

Details of certain of these searches for bettered thermal efficiency will be treated in ensuing issues of ELECTRICAL WORLD. It will be of interest a decade hence to look back and see which, if any of these unique schemes, attained commercial practicality.

Imagination in Selling

WHEN YOU GET to be 120 years old and your house burns down, that will be tough. If you do and if it does, you will be in the same fix as Joaquin Paipa was last winter. Joaquin, an Indian, is undoubtedly the dean of oldsters around San Diego, California. There he was, his shack burned down and all his small possessions inside of it.

Officialdom was slow to act in his plight. So volunter assistance came forward and a Joaquin Paipa Home-Building Committee was organized. In it the Bureau of Radio and Electrical Appliances of San Diego County saw a merchandising opportunity as well as an opportunity to help polish up a good deed for shining in this naughty world.

The bureau set up a campaign to sell 1,000 electric bed coverings in January and February, pledging $1 to the JPH-B Committee for each one sold. The goal was reached and a check for $1,000 was delivered to the chairman of the committee early in March. The dollar per sale was contributed as follows—25¢ from the retail dealer, 25¢ from the distributor, and 50¢ from the bureau.

Here was a fine example of imagination in selling, the kind of showmanship that moves the goods. We need more of it.

The Electrical Week

If mobilization goes all out, a new super-agency may direct civilian war effort. Washington gossip even gives the agency a name, National Mobilization Agency. And NMA would be super. It would have all powers of the separate control agencies of the last war (p 64) . . . But so far Congress has been slow in writing a law to give the President control over production, prices, and wages. But this seems certain. NSRB will rule production, and the Commerce Department will handle priorities, allocations, and inventory ceilings (p 64) . . . What effect mobilization will have on the appliance industry is still in doubt. But not so far as the public is concerned. Appliance sales have been soaring. The result: a scarcity and higher prices (p 65) . . . NSRB is considering allocating a major share of the power from Reclamation's Central Valley Project to a new aluminum plant (p 66) . . . BPA in its report for fiscal 1950 announced a ten-year construction plan (p 67) . . . Carroll Wilson has resigned as general manager of AEC. He says that he has no confidence in new chairman, Gordon Dean (p 68) . . . And output for the week ended Aug 5 moved up to a record high of 6,247,464,000 kwhr (p 70).

• • •

Interior Secretary Chapman has ordered the Bonneville Power Administration to make more power available for aluminum production. BPA says it has no surplus, can offer only interruptible power until it obtains more generating capacity.

A Senate committee wants to make a quick survey of the nation's fuel supplies for both war and peace. The committee's study would cost $20,000. It would be completed by Sept 15, and, the committee said, would help formulate a national fuel policy.

While the government and some segments of the aluminum industry expressed alarm over power supply, a major utility system came up with an answer. It offered to make available for new aluminum production 150,000 kw of generating capacity. As yet there have been no takers.

You can read all of the Atomic Energy Commission's non-secret reports at any one of 31 libraries which have been designated official depositories by AEC. Reports now number 3,500, and new ones are being issued at a rate of 1,500 per year.

Prices of power equipment are going up in line with the schedule previously announced by Westinghouse Electric Corp (EW, Aug 7, p 3). General Electric Co and numerous smaller manufacturers have been heard from. Increases are as follows: Power transformers 7½%, distribution transformers 10%, switchgear 10%, meters 5%, insulators 10%, motors and control equipment 10%. Turbogenerators no increase, but there is a 10% escalator clause. Conductor prices have been reported up as much as 15%.

IBEW representatives will visit all of the union's locals before election time to get members to step up contributions to the AFL's political campaign. The AFL, asking $2 from each of its 8 million members, has collected only $300,000. IBEW will also urge the men to register for voting.

When Bonneville Power Administration started doing business in Washington in 1935, there were 60 private power companies. Today there are 13. Six of the 60 were taken over by other private companies, nine ceased operations, and 32 were taken over by public systems, mostly by public utility districts.

Notes From The News

A federal court judge has enjoined residents of Royal Oak, Mich., from interfering with Detroit Edison Co's plans to build a high tension power line between Royal Oak and Pontiac. The residents claimed the power line towers would be unsightly and would interfere with radio and television reception . . . The city council of Hanover, Ill., has authorized a survey to determine the size and cost of a municipal electric generating plant. The city now is served by Northwestern Illinois Gas & Electric Co . . . Georgia Power Co's new power plant will be named McManus Plant for C. B. McManus, president of the utility. The exact site for the 120,000-kw plant has not been decided . . . The Electrical Utilities Employees Union has ended a 10-day strike against Regina (Sask.) Light & Power Department following conclusion of a wage agreement with city officials. The strike forced a brown-out almost everywhere except in hospitals . . . Ohio Power Co has completed excavation work for a 132-kv switching station 4 miles southeast of Hillsboro. The station will be the northern terminus of a line to be built in Kentucky . . . Radio Corporation of America demonstrated last week that its all-electronic color television system can use standard coaxial cables to carry programs in color from point to point over long distances. During the demonstration color signals from a program originating in Washington, D. C., were transmitted over more than 200 miles of coaxial cable to New York.

If Mobilization Goes All Out—NMA May Take Over

If mobilization goes all-out—if war spreads—a new government super-agency may direct the civilian war effort. That's the thinking in some Washington circles.

The hypothetical agency even has a name: National Mobilization Agency. It's bandied around in capital planning sessions as NMA.

NMA would boast all the powers of separate control agencies in World War II and maybe more. Planners differ on the details, but they agree that NMA probably would have three main divisions:

1. Manpower, including selective service, a new War Labor Board, and other personnel control programs.

2. Production, a new WPB.

3. Economic stabilization, to get OPA's job and other economic controls.

NMA would run the machinery of mobilization, but the National Security Resources Board still would serve as a planning and advisory group. NMA planners want to maintain the present status of NSRB, which presumably would be kept alive after another war. And NMA could be expected to draw on NSRB personnel in setting up its own shop.

NMA, thus far, is largely talk, but it will get serious consideration in Washington if war spreads beyond Korea.

The NMA idea has some good points. It's a business-like approach to getting big wartime jobs done in a hurry. NMA could provide executive coordination of the different phases of wartime regulation—in contrast to World War II's piecemeal agency-for-this and agency-for-that. It could make it easier for American industry to do business in Washington by giving centralized management to emergency regulations.

But there might be disadvantages. NMA would wield unprecedented power, more than any agency had in the last war, perhaps more than the public would tolerate in any but the most desperate emergency. Or, if improperly directed or staffed, it might be the opposite, a weak, new federal agency contributing only confusion.

Congress Delays Mobilization Set Up

Failure to Pass Law Giving Truman Control Authority Limits Administration to Mere Planning; NSRB to Govern Production

THE MACHINERY for running the stepped-up mobilization program is being set up—at least in broad outline.

The administration can't do much more right away than draw the lines of authority—because Congress is taking more time than expected to write a law to give President Truman power to control production, prices, and wages.

But this much can be set down with certainty:

The National Security Resources Board is going to estimate the production needed for essential goods, and, by subtracting from total production capability, set the amount of materials and machines available for so-called non-essential production.

Commerce is going to have the job of writing the limitation orders, the priorities and allocations, the inventory ceilings, and the like.

There is good reason to believe, but not with complete surety, that Interior Department will be the place to go for materials needed for generators, component parts, power lines. Secretary Oscar L. Chapman is putting in an influential bid for the job at the White House—where he carries weight.

Also a fight is still going on between Commerce and NSRB over which one will control materials and production for purely civilian use.

NSRB wants the job. Chairman W. Stuart Symington sees civilian allocation as a piece of his broader job of deciding defense needs. His position is, why have two agencies doing separate parts of the same job?

Commerce Secretary Charles Sawyer, on the other hand, figures that his department should take charge once Symington has decided defense requirements.

Sawyer says that Commerce would have to do the paper work anyway; that Commerce has the experts, the intimate contacts with industry necessary to make the operation run smoothly. Besides, Commerce officials say, their department is an operating, cabinet-rank outfit, while NSRB is a policy-advising arm of the President.

Truman will have to settle this tug-of-war, just as he will have to decide whether Interior will be the requirements spokesman for electric power as well as for petroleum, natural gas, and coal.

As a matter of fact, it isn't going to make much difference to the business man who gets the authority. The big question is, how soon and on what materials are the controls going to hit?

A ceiling on inventory will be the first control put on once the Defense Production Bill becomes law. The Commerce Department has already drafted the order. It will set ceilings on supplies at a company's historical, normal amount. Cable, meters, transformers, conductor and the like—items using copper, aluminum and other strategic materials—would be hit by the first order.

However, coal may not be put under control immediately, and oil supplies are sufficiently large also, which means storage of fuels may be free for sometime.

The first allocations order will be on rubber. This will come in about a month. Priorities for copper will follow within two weeks, aluminum not too far behind.

As a matter of fact, aluminum and steel already are being parcelled out on a voluntary basis. Past performance is the criteria for getting supplies.

Unless the Korean situation worsens materially, electric companies should run into little trouble getting what they need. Power is a high priority item both for defense and civilian use.

Pots and pans manufacturers will have their aluminum and copper cut off entirely before any cutbacks are even considered on electric utility supplies.

This does not hold true, entirely, for rubber. The first changes you'll see there will be a reduction in the amount of natural rubber that goes into the mix with synthetic.

Just how long all this business will be left in the hands of existing governmental agencies is a question. So long as the squeeze is only mild—say a 10% skim off industry's materials and machines—Commerce, Interior, and NSRB probably will run things.

But war, or an inter-bureau squabble over jurisdiction, would prompt the President to put the whole operation into the hands of a specially created agency.

FPC Forecasts Increase in Southwest Power Needs

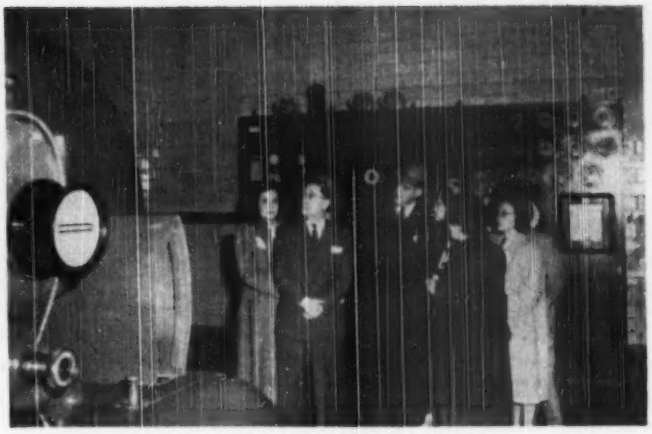
Power requirements of electric utilities in the Southwest will jump to 45.3 billion kwhr in 1970, three times the area's 1947 total demand of 14,698 million kwhr. That's the Federal Power Commission's estimate in a revised edition of its regional power market survey.

The region includes Arkansas and Louisiana, most of Kansas and Oklahoma, and portions of Texas, Missouri, and Mississippi. This area will experience steady growth in energy requirements up to 1970, the study indicated. Total utility requirements by 1955 were forecast at 25,860 million kwhr, rising to 32,380 million kwhr by 1960.

Presently scheduled additions of dependable capacity by 1955 total 2,865,000 kw—104% of the dependable capacity on January 1, 1948. But an additional 1,568,000 kw will be required by 1960 and 5,365,000 kw by 1970, FPC predicts.

Most rapid gain in power use is expected on farms, of which an estimated 78% will be electrified by 1970, compared with 46% in 1947. Average farm use is expected to jump from 1,100 kwhr to nearly 4,600 kwhr annually by 1970. This would boost farm consumption to 4.3 billion kwhr, seven times the 1947 level.

Non-farm residential consumers are expected to use 3,600 kwhr annually in 1970, compared with 1,139 kwhr in 1947, with annual sales in 1970 forecast at 11.3 billion kwhr, five times 1947 sales. Commercial sales were seen increasing from 2.8 billion kwhr in 1947 to 8.2 billion kwhr in 1970. And industrial use was estimated at 17.7 billion kwhr in 1970, compared with 8.5 billion kwhr in 1945.



GROUP OF TEACHERS from the Ohio Edison Co service area are shown inspecting the turbine room of the utility's Gorge Plant on a recent tour. Acting as their guide is Andrew Carnegie (third from left), superintendent of power production for Ohio Edison

Effect of War on Appliance Makers Still Uncertain; Consumer Sales Up

FULL IMPACT of government mobilization controls and military demands on the appliance, radio, and television industry was still not clear last week.

Some Washington observers predicted that 1951 appliance production would be trimmed 15 to 25%. But manufacturers still were waiting for definite word.

Meanwhile consumers rushed to buy in apparent expectation of short supplies, higher prices, and credit control. A Senate committee's approval last week of a proposed 10% excise tax for television and deep-freeze units offered an added incentive to scare buying.

Although industry production schedules were set as high as parts supply would allow, goods already were scarce in many markets and some prices were up.

From the factory down the line to the retailer, refrigerators were being tightly allocated. Supplies of some electric housewares were short. Demand was heavy for ranges, washers, and freezers. Television, stimulated by early summer introduction of new models at lower prices, was booming.

Sales volume in the industry generally had suddenly soared. But it was hard to tell to what extent the invasion of Korea and the threat of controls were responsible. Most dealers attributed at least part of the increase to a seasonal pick-up in refrigerators and the introduction of new radio-television lines.

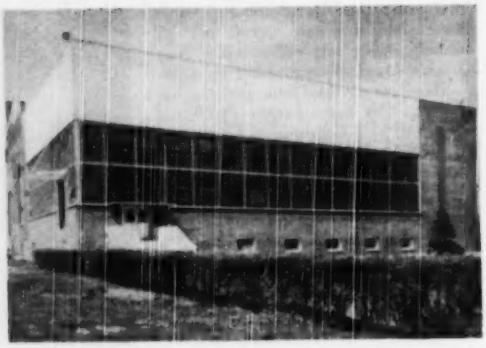
Prompted by mounting sales and shrinking inventories, dealers began to place heavy orders with distributors. By the end of July many wholesalers had reimposed some sort of allocation based on the retailer's previous volume.

Trying not to stimulate consumer scare buying, manufacturers were making no formal announcements of allocations programs. Westinghouse, for example, reported that most of its appliances were being allocated but gave no details.

Television led a wavering price climb. Some smaller manufacturers followed Philco, Emerson, and Du Mont in boosting tariffs.

Emerson Radio & Phonograph Corp announced late in July that "interim" prices quoted on its television line in late June were being raised 3 to 16%. A few days later Allen B. Du Mont Laboratories, Inc, upped its early July price schedules by 10%, effective Sept 1. Philco Corp followed Aug 2 with new prices averaging 7% above those suggested when the 1951 models were released.

Several smaller manufacturers immediately raised prices, but some other large companies held back, hoping it would not be necessary. However, there were plenty of loopholes in their statements. General Electric introduced its new line in July with the warning that prices "might" have to be raised before



BLASTED PLANT of Southeastern Indiana Electric Co at Rushville (left), has been rebuilt (right) and is now operated by Public Service Co of Indiana, which bought Southeastern facilities this spring. The plant was wrecked Sept 15, 1949, when a diesel engine exploded

the end of the summer. Emerson said further increases might be made later.

There were scattered rises in the appliance field. Duchess washers were upped $10, and Thor raised prices on two of its washers. Gibson suggested increases on its ranges and refrigerators, and Coolerator boosted the prices of ranges, refrigerators, and freezers.

Manufacturers were divided on the outlook for the future. Some predicted a substantial shift of production capacity to military electronic equipment and shortages of appliance components because of increased government buying. Others pooh-poohed the effect of a "relatively small" partial war budget, pointed out that the $10-to-$20-billion expenditure now visualized for carrying on the Korean war is relatively small and should be reflected in a correspondingly small shift in industry.

Dealers meanwhile were too busy trying to keep up with current business to make many predictions. One in New York reported he had cut discounts in half and was going to try to sell at list prices. Another said customers again were being polite to employees.

In Washington two big distributors were cleaned out of inventory. One dealer had so much business he didn't even have time to keep his records in order; another voluntarily adopted Regulation W to control credit.

Southern sales of almost every type of electrical appliance and radio and television set doubled and in some cases tripled. Said an Atlanta dealer, "We've been doing better this year than ever before. . . This is scare buying if I ever saw it."

A Midwestern dealer summed up the demand for larger appliances: "You can sell anything you've got just so it is painted white."

Aluminum Plant May Get Largest Portion of Central Valley Power

THE NATIONAL SECURITY RESOURCES BOARD is considering a plan to allocate the lion's share of power from the Bureau of Reclamation's Central Valley Project for the operation of a new aluminum plant.

Three potlines with a total annual capacity of more than 100 million lb of aluminum could be operated with power from Shasta and Keswick Dams. Surplus potlines from World War II are available in the area, but they would have to be relocated.

NSRB, in consultation with the Munitions Board, will decide whether the present situation justifies earmarking a large share of the nearly 2 billion-kwhr annual output of the northern California federal power plants for expanding aluminum production.

Democratic Representative Clair Engle, in whose district the power projects are located, disclosed Aug 7 that NSRB Chairman W. Stuart Symington has been asked to approve the power allocation. Engle said that both Reynolds and Kaiser are interested in plans for the new plant.

The three potlines for the new production facility would come from the federal Riverbank Plant near Modesto, Calif. This plant, now idle, was operated by the Aluminum Co of America during the war. Power came from the Hetch Hetchy plant which now supplies the municipal power needs of San Francisco. In addition, the aluminum lines have been tagged for removal because fumes from wartime operations imperiled agriculture in the vicinity. Under the plan now being considered, the potlines would be moved to a site nearer the Central Valley projects.

Shasta (379,000 kw) and Keswick (75,000 kw) actually can supply for aluminum production only about the 120,000 kw of firm capacity estimated to be needed for operating three potlines, Interior engineers calculate.

Power from the two dams now is sold to Pacific Gas & Electric Co on a day-to-day basis. Negotiations over a period of two years have failed to produce a long-term contract between the company and Reclamation for disposal of the power.

If the power allocation for aluminum production is approved, Interior is expected to press for Congressional authorization and funds for other proposed power developments in the Central Valley. These would include projects on the Trinity River and perhaps even the controversial Delta Steam Plant. The proposed allocation also would stimulate new consideration of a power link between Central Valley and the system of Bonneville Power Administration which markets the output of federal dams on the Columbia River.

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Work to Start on Station

Niagara Mohawk Power Corp will build a 160,000-kw steam-electric generating station at Albany on the west bank of the Hudson River. Work on the $27-million project will begin immediately. The plant is expected to be completed in the fall of 1952. The new station is part of Niagara Mohawk's expansion program which will add more than 600,000 kw to its system by 1952.

BOSSING THE MEN, as chairwoman of the joint employer-labor committee of Meridian, Miss., is Mrs Beatrice D. Pace, owner of Pace Electric Co. The committee directs a city-wide apprenticeship program in the electrical trade. The men represent other electrical firms and the International Brotherhood of Electrical Workers, AFL. Committee functions virtually as a vocational education institution

BPA Outlines Construction Plans in Northwest During Next 10 Years

BONNEVILLE POWER ADMINISTRATION'S schedule of construction for the next ten years is the feature of its annual report for the fiscal year ended June 30.

The construction program, drawn up before the Korean crisis, calls for no additions to capacity until 1952 except at Grand Coulee Dam. Here a 108,000-kw unit is to be installed in the fall and three more in 1951.

In 1952, if the war situation in Korea does not alter BPA's plans, two units with a capacity of 142,500 kw will go on the line at Hungry Horse Dam in Montana. The following year an additional 142,500 kw will be put into operation.

Installation of three new units at Grand Coulee during the 1950 fiscal year brought the installed capacity of Bonneville and Grand Coulee Dams up to 1,922,400 kw nameplate rating, with a safe continuous capacity under favorable operating head conditions of 2,124,000 kw. BPA transformer capacity was increased to 3.4 million kva as the fiscal year ended, a 14% rise over June 30, 1949.

The aluminum industry was BPA's largest customer during the last fiscal year, buying 5,863,500,000 kwhr out of a total 13,033,200,000 kwhr sold. Privately owned utilities purchased 3,311,800,000 kwhr, publicly owned utilities 2,841,400,000 kwhr, and other industries and military establishments 1,106,500,000 kwhr.

In April, May, and June of this year electric energy sales to the aluminum industry topped the 500 million kwhr mark for the first time and exceeded sales to privately owned utilities by 100 million kwhr.

Total sales for the past fiscal year were 9% above the 1948-49 figure of 11,962,000,000 kwhr. For the same period revenue increased 13% from $27,533,000 to $31,003,000.

A schedule of the joint program of the Army's Engineers, Bureau of Reclamation, and BPA for the next ten years follows:

1953—DETROIT DAM, 2 units, 100,000 kw; BIG CLIFF DAM, one unit, 18,000 kw; MCNARY DAM, two units, 140,000 kw.

1954—MCNARY DAM, 3 units, increasing capacity to 350,000 kw; ALBENI FALLS, 2 units, 28,400 kw; ROSA DAM, 2 units, 10,000 kw; CHANDLER DAM, 2 units, 12,000 kw; PALISADES, one unit, 22,500 kw; LOOKOUT POINT (Meridian) 3 units, 115,000 kw; HILL CREEK DAM, one unit, 20,000 kw.

1955—DEXTER DAM, one unit, 15,000 kw; ALBENI FALLS, one unit, increasing capacity to 42,600 kw; MCNARY DAM, 3 units, increasing capacity to 560,000 kw; PALISADES, 2 units, increasing capacity to 67,500 kw; DEXTER, one unit, 15,000 kw; ICE HARBOR, 2 units, 130,000 kw.

1956—MCNARY, 3 units, increasing capacity to 770,000 kw; ICE HARBOR unit, increasing capacity to 195,000 kw; UPPER SCRIVER CREEK, one unit, 15,000 kw; LOWER MONUMENTAL, one unit, 60,000 kw; CHIEF JOSEPH, 3 units, 192,000 kw.

1957—MCNARY, 3 units, increasing capacity to 980,000 kw; ICE HARBOR, one unit increasing capacity to 260,000 kw; UPPER SCRIVER CREEK, one unit, increasing capacity to 240,000 kw; CHIEF JOSEPH, 3 units, increasing capacity to 384,000 kw; GARDEN VALLEY, 2 units, 30,000 kw; HELLS CANYON, 3 units, 300,000 kw; LITTLE GOOSE, one unit, 65,000 kw.

1958—CHIEF JOSEPH, 3 units, increasing capacity to 576,000 kw; GARDEN VALLEY, 2 units, increasing capacity to 60,000 kw; HELLS CANYON, 2 units increasing capacity to 500,000 kw; LITTLE GOOSE, 3 units, increasing capacity to 260,000 kw; LOWER SCRIVER CREEK, 3 units, 90,000 kw.

1959—CHIEF JOSEPH, 3 units, increasing capacity to 768,000 kw; HELLS CANYON, 2 units, increasing capacity to 700,000 kw; LIBBY, one unit, 98,000 kw.

1960—CHIEF JOSEPH, 3 units, increasing capacity to 960,000 kw; HELLS CANYON, one unit, increasing capacity to 800,000 kw; LIBBY four units, increasing capacity to 490,000.

1961—CHIEF JOSEPH, one unit, increasing capacity to 1,024,000 kw; LIBBY, one unit, increasing capacity to 588,000 kw.

During this 10-year period non-federal installations are scheduled to add 967,900 kw to Northwest production. These include: Idaho Power Co., 291,000 kw; California Oregon Power Co, 116,300 kw; Seattle Light, 420,000 kw; City of Eugene, Ore., 20,600 kw; Rock Island, Wash., 120,000 kw.

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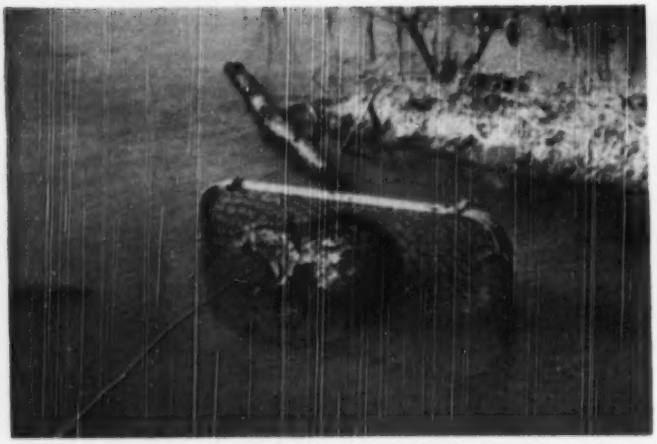
Senate Committee Tables Copper Duty Suspension

Copper may yet be duty-free despite a 9-4 Senate Finance Committee vote Aug 8 to bottle up a House-passed bill that would have reinstated the tariff suspension which expired July 1.

The Senate committee did approve a bill suspending duties on imported scrap copper. Advocates of suspension were expected to try to amend this to include raw copper when the new measure finally should reach the floor of the Senate.

Vote by the Committee postponed "indefinitely" consideration of the House bill providing for retroactive suspension to July 1. It would have continued the suspension to July 1, 1951.



BEAVER is caught in a trap set by Union Electric Co of Missouri near Bagnell Dam. The beavers endanger transmission tower footings. Five full-grown beavers have been caught at the dam in one month. They are taken to a reservation and turned loose there

AEC General Manager, Carroll Wilson, Resigns

Carroll Wilson, general manager of the Atomic Energy Commission, has resigned as a result of differences with the recently named commission chairman, Gordon Dean.

President Truman appointed Wilson's assistant, Deputy General Manager Carleton Shugg, to serve as acting general manager until a permanent appointment is made. The President appoints the AEC's general manager, subject to confirmation.

Wilson declared that he lacked confidence in Dean.

"I regret that I do not have the degree of confidence in the chairman of the commission which I believe it is essential that I should have in order to serve him and the commission effectively in administering the program," Wilson said in a statement issued after President Truman accepted the resignation Aug 8.

Wilson complained of a "steady trend during the past year in the direction of the commission as a body assuming the direct role of management of the program."

"I have serious apprehension that the ultimate projection of this trend will result in a cumbersome slow moving administrative machine which is incapable of giving the country the kind of direction needed to maintain and increase our leadership in the atomic field."

Wilson, 39, became AEC's first general manager Jan. 1, 1947, when the civilian commission took over the atomic program.

Shugg was appointed deputy general manager on Sept 1, 1948. He has been responsible for coordinating and expediting the technical and scientific phases of the commission's operations. Prior to this appointment, he was manager of operations at Hanford, Wash., where he supervised the construction of the plutonium production plant and also its expansion.

A native of Boston, Shugg graduated from the Naval Academy in 1920. Resigning from the Navy in 1929, he joined the Sprague Electric Co in Massachusetts, serving as factory and production manager. In 1940 he went with the Cramp Shipbuilding Co where he directed production until 1943. He joined the Todd Shipyards Corp in New York and in 1947 was made general manager of its Hoboken and Brooklyn divisions.

PIP Meeting Scheduled

Those in charge of public relations and advertising for members of the Electric Companies Public Information Program have been invited to a "Workshop Conference," Sept 14-15 at the Stevens Hotel, Chicago. Major objectives of the conference are to (1) foster understanding of the aims and methods of PIP, particularly the function of the local company in implementing the broad national program, (2) provide for free and active discussion and interchange of ideas, suggestions, and criticism, and (3) underscore the urgency and importance of PIP to the individual, the company, and the industry.

No Strikes Threatened at Atomic Energy Plants

Despite the fact that major labor contracts at Oak Ridge atomic plants expired more than a month ago, no strike has broken out, nor is one threatened. The disputes involving CIO and AFL unions are being handled by the atomic energy labor relations panel set up last year.

The CIO Gas, Coke, and Chemical Workers contract at the K-25 gaseous diffusion plant expired June 9. The AFL's contract at the X-10 national laboratory ran out June 30. Both plants are operated for the government by Carbide & Chemicals Corp.

Union Rivalry a Complication

The settlement of the disputes is complicated by efforts of the company to equalize wages paid in both places for the same work and the rivalry between the two unions. Each union seeks to gain as much if not more than the other union is able to for its members.

The CIO is demanding a general wage increase and correction of inequity in job rates. It also seeks an increase in severance pay allowance. The union is stressing severance pay as against pensions because of the uncertainty of the duration of jobs in atomic energy. The company's offer of a pension plan has been received coolly by the union mainly because most workers have been with the company for only a few years. It would be a long time before they would be eligible for a pension.

AFL Near Settlement

The atomic energy labor relations panel has stepped into the CIO dispute and has given the union a hearing. The panel also has intervened in the AFL dispute, but collective bargaining has continued and the company and union are reported near agreement. The actual signing of the contract, however, will have to wait conclusion of the CIO case in order to more or less equalize the two settlements.

President Truman established the panel in April, 1949, to settle disputes in the atomic energy field without strikes or lockouts. The current disputes are the 11th and 12th cases to be handled by the three-man panel, headed by William H. Davis, former chairman of the National War Relations Board.

Somewhat similar to the railway mediation board, the atomic energy panel uses mediation and conciliation, with delaying steps. It may make recommendations for settlement, and often it refers a dispute back to the parties for further bargaining.

Changes in Capacity Reported to Federal Power Commission

PLANT ADDITIONS DURING JUNE

Utility	Plant	Fuel	Capacity (Kw)
New York State Electric & Gas Co.	Jamison	S	30,000
Pennsylvania Electric Co.	Seward	S	46,000
Illinois Power Co.	Havana	S	40,000
Manitowoc Public Utilities	Manitowoc, Wis.	S	10,000
Northern States Power Co.	Holcombe, Wis.	H	11,250
Iowa-Illinois Gas & Electric Co.	Manson, Iowa	IC	1,000
Iowa Electric Light & Power Co.	Prairie Creek	S	80,000
St. Joseph (Mo.) Light & Power Co.	Edmond St.	S	19,500
Empire District Electric Co.	Riverton, Neb.	S	30,000
Western Light & Telephone Co.	Phillipsburg, Kan.	IC	2,400
Lacrosse Electric Department	Lacrosse, Kan.	IC	685
Wilson Water & Light Department	Wilson, Kan.	IC	360
Osawatomie Electric Light & Water Department	Osawatomie, Kan.	IC	1,935
Kansas Power & Light Co.	Hutchinson	S	40,000
Consolidated Gas, Electric Light & Power Co.	Westport, Md.	S	66,000
Potomac Electric Power Co (D. C.)	Potomac River	S	80,000
Virginia Electric & Power Co.	Bremo Bluff	S	60,000
Carolina Power & Light Co.	Lumberton, N. C.	S	44,000
Virginia Electric & Power Co.	Kitty Hawk, N. C.	IC	600
Arkansas Power & Light Co.	Lake Catherine	S	44,000
Texas Electric Service Co.	Morgan Creek	S	18,750
Floydada Electric Department	Floydada, Texas	IC	160
Bryan Light & Power Plant	Bryan, Texas	S	5,000
Houston (Texas) Lighting & Power Co.	West Junction	S	75,000
Central Arizona Light & Power Co.	Phoenix	S	50,000

PLANT RETIREMENTS DURING JUNE

Iowa-Illinois Gas & Electric Co.	Ft. Dodge, Iowa	IC	1,000
Wilson Water & Light Department	Wilson, Kan.	IC	120
Virginia Electric & Power Co.	Woodstock No. 3	IC	250
Virginia Electric & Power Co.	Charlottesville	S	2,500
Public Service Co of Oklahoma	Thomas	IC	85
White River Electric Association	Meeker, Col.	H	125

H—Hydro, IC—Internal Combustion, S—Steam
United States Capacity as of July 1—Steam, 46,585,671 kw; Internal Combustion, 1,841,533 kw; Hydro, 17,299,240 kw; Total, 65,596,444 kw.

WRPC Gets Old Ideas for U. S. Water Policy

The President's Water Resources Policy Commission now touring the country to get advice and suggestions on which a national policy can be based has been getting both. But the advice and suggestions are not new. Both have been stated many times before.

In general electric utilities oppose all federal power projects unless the power is sold to them. They are willing to allow the government to develop water resources for domestic and industrial supply, flood control, irrigation, recreation, navigation, and conservation of wild life.

Pro-public power advocates want the government to develop hydro power. Some co-op leaders also favor this.

Labor unions are joining the private power-free enterprise camp.

At the recent conference at Atlanta C. B. McManus, president of the Southern Co, offered to purchase and distribute all energy produced at government projects. J. Herbert Macon, representing Alabama's lieutenant governor, also endorsed sale of power to the private companies.

On the other hand P. O. Davis, director of the Alabama Agricultural Extension Service and president of the Southeastern Resources Development Association, urged increased governmental river basin development. "We are concerned not with one basin or one river valley but with the development of all river basins and the use of all resources in the Southeast."

In a preceding conference held for New England at Springfield, Mass., both the International Brotherhood of Electrical Workers, AFL, and the Utility Workers Union of America, CIO, had representatives testify in favor of free enterprise. They pointed out that when public power comes in, union labor goes out.

Governor Dever of Massachusetts favored federal hydro development giving as one of his reasons the high power rates charged by utilities. This brought the retort from Joseph A. Fisher, UWUA president, that the commission which regulates rates in Massachusetts is responsible to the governor. "If the governor is so concerned by high rates . . . why doesn't he do something about them."

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TVA Dam Attendance Up

The number of visitors at 15 major dams of the Tennessee Valley Authority increased sharply in June. More than 793,000 persons visited the dams in June compared with 621,900 in May. An overlook will be built at the South Holston Dam for sightseers. The building will feature an observation room and an outside concrete deck. Work is expected to begin about the first of next year.

Citizen Sues Pepco, Says Utility Overcharged U.S.

A private citizen is suing an electric utility for alleged overcharges to the government. The suit filed in District of Columbia District Court seeks to have Potomac Electric Power Co pay the federal government $554,000.

Pepco serves government buildings in Washington, and Edward A. Leslie, a rate consultant, contends that the government was overcharged in the summer of 1948. If his suit is successful, Leslie will get 25% of any money awarded the government under an 1863 statute. Or, if the government steps in and prosecutes the suit, he can receive 10% of any award.

Retroactive features of a $3-million rate boost granted Pepco July 21, 1948, by the District Public Utilities Commission are the basis of the suit. Leslie says that Pepco charged the increased rate for some energy consumed prior to that date by applying the new rates to all meter readings taken on July 21 and thereafter.

Pepco points out that this practice has been approved by the PUC in other rate changes, including rate reductions made over a period of many years. Meanwhile, another challenge to this method of effecting rate changes has come in the widely publicized decision of District Court Judge T. Alan Goldsborough who disapproved a rate increase the PUC granted Washington Gas Light Co (EW, July 3, p 65). Goldsborough ruled against similar retroactive provisions in the decision which is being appealed by the gas utility and the PUC.

The Leslie suit seeks payment by Pepco to the government of $75,000 in repayment for alleged overcharges, a penalty of $75,000, and $2,000 for each of 202 claimed overcharges for service to government buildings.

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Power Shortage Looms in Canadian Province

A power shortage looms in Manitoba unless Winnipeg and the provincial government can come to agreement on the control of Manitoba's chief sources of electric power. Negotiations have been going on for two years.

The best existing sites are owned by Winnipeg's municipal system and Winnipeg Electric Co. The Manitoba government wants to expropriate the properties and form a hydro authority for the whole province.

The deadlock is delaying plans to develop more power sites to meet increasing consumer demand.

FINANCIAL

YIELDS (%) — Operating Electric Utilities Bonds

Quality	Bonds			Preferred Stocks			Common Stocks		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
DATE									
1950									
Aug. 3	2.62	2.62	2.74	3.83	4.04	4.38	5.81	6.74	7.73
July 27	2.62	2.65	2.75	3.83	4.05	4.40	5.87	6.89	7.83
END OF QTR.									
2nd 1950	2.68	2.66	2.74	3.79	4.03	4.38	5.38	6.51	7.50
1st 1950	2.59	2.61	2.74	3.78	4.01	4.36	5.22	5.85	6.67
4th 1949	2.59	2.61	2.72	3.85	4.06	4.46	5.37	6.15	7.01
3rd 1949	2.61	2.65	2.77	3.88	4.15	4.54	5.55	4.67	7.51

New money financing by electric utilities slowed down to a thin trickle in July with a stock market still depressed by fear of war taxes.

No new money stock offerings were made to the public, and there was only one public bond sale, $3.5 million of first mortgage 2⅞'s by Kentucky Utilities Co. Even that reportedly sold slowly.

Summer is always a slow period for financing. But last month's figures were in sharp contrast to July of 1949, when electric utilities offered the public $53,750,000 in bonds, $30,125,000 in common stock, and $5 million in preferred to raise new money.

Private placements last month totaled at least $32 million. Only one of these was preferred stock, $2 million by Atlantic City Electric Co. Bonds made up the rest.

No sharp recovery is indicated by the number of stock and bond issues now in registration. Indicated for August sale are $12 million of first mortgage bonds by Duquesne Light Co and $3.6 million of first mortgage sinking fund bonds by New Hampshire Electric Co. Delaware Power & Light Co expects to offer $12 million of first mortgage bonds in September, and Utah Power & Light Co has registered $8 million of first mortgage bonds and 166,604 shares of common, probably for October sale. New Orleans Public Service proposes to issue 160,074 shares of common, but only a small fraction will be offered to the public. The remainder will be taken by the parent company, Middle South Utilities.

Still indefinitely deferred are $15 million of Consumers Power Co common and a million shares of Southern Co common, whose sale was postponed early last month because of the unsettled market. Public Service Co of Colorado is reducing its $17-million financing to $10 million but has set no date for the smaller sale.

Seattle Voters Will Pass on Purchase Bond Issue

Seattle voters will have their first chance to approve a City Light bond issue Nov 7 when they vote on the proposed purchase of Puget Sound Power & Light Co properties in the Seattle competitive area for $25,850,000.

Approval of the purchase also will mean approval of a revenue bond issue to finance it. All past City Light bond issues, totaling some $70 million, have been approved only by the city council, but the council felt there should be a popular vote on the matter of such public importance as this one.

Only a majority is required for passage of the purchase proposal. If it failed, the question could not be submitted to the voters again for two years.

The purchase bonds would be tax-exempt, maturing in 25 years, with payments on the principal to begin in five years after issuance and continue at about $1 million a year. Earnings of the properties being acquired will be enough to retire the bonds, the city feels.

The acquired properties will pay the same state and city taxes as under private ownership, except for real estate taxes, said A. C. Van Soelen, city corporation counsel. However, the merger will boost City Light's utilities occupation tax by 1%, the penalty for being a monopoly.

Meanwhile, a committee of the Seattle Chamber of Commerce has made a detailed analysis of the proposed purchase and called it a "real bargain." It found that "the proposed purchase price is substantially less than what the properties are worth at present-day prices and what it would cost the city to expand its own system to take care of the total load."

New Hampshire Co-op Buys White Mountain Co

White Mountain Power Co, Meredith, N. H., has been sold to the New Hampshire Electric Cooperative, Inc, Plymouth, for about $1,295,000. The purchase was financed by a Rural Electrification Administration loan of $2,950,000, of which $200,000 went to White Mountain as a grant to complete internal financing requirements.

The co-op plans expansion of facilities to reach about 2,000 more customers. It will build about 600 mi of additional rural lines. For the present White Mountain will be operated as a separate organization.

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Propose PUD Bond Issue

Commissioners of Hood River Public Utility District in Oregon have called an election Sept 19 on a proposal for a $1-million bond issue. Proceeds would be used to acquire power facilities in the district, which includes the Hood River valley except for the city of Hood River. The area now is served by Pacific Power & Light Co and Hood River Electric Cooperative. Members of the locally owned co-op, lacking funds for expansion, recently voted to offer the properties for sale to the PUD.

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Expropriation Case Ends

Final disposal has been made of the case involving British Columbia Power Commission and three companies expropriated five years ago. Under the decision handed down by Justice J. O. Wilson at Victoria the commission will pay $1,211,792 to West Canadian Hydro Electric Co, $67,000 to Columbia Power Co, and $601,000 to Nanaimo-Duncan Power Co. The delay resulted when the companies appealed the original awards.

FINANCIAL BRIEFS

Salt River Valley Waters Users Association and its companion Salt River Power District have started to make a profit. In the past two years the earnings were $3,790,000, compared to $16,916 in 1946-47. Pres Richard D. Searles said the association is in the soundest financial position in its history.

Westinghouse Electric Corp last month redeemed $40 million of its $80 million issue of 2.65% debentures due July 1, 1973. Redemption was set at 104% plus accrued interest. This is the second such Westinghouse action within a year.

Speculation Rife on Site for New AEC Project

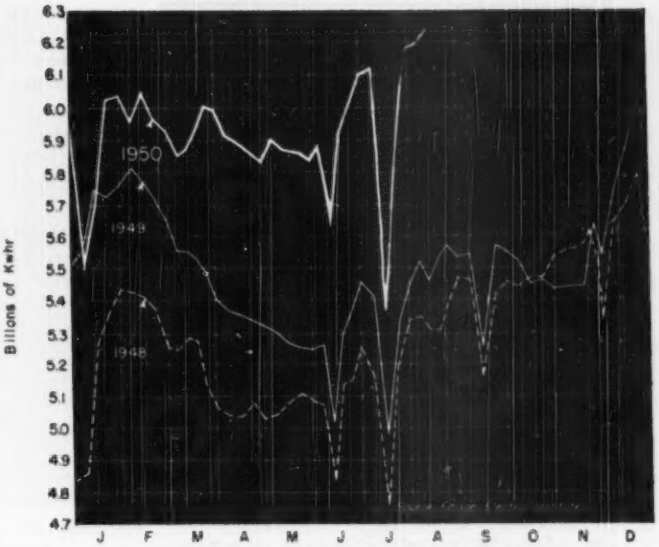
Announcement by the Atomic Energy Commission Aug 2 that Du Pont will build and operate "new production facilities"—presumably for an H-bomb—has sparked speculation on the site of the new project.

Power requirements and other data on the operations are secret, but it's expected that a big block of power and access to water will help determine the site.

If the power needs are on the order of AEC's two big production plants at Oak Ridge, Tenn., and Hanford, Wash., both of those areas are probably out. TVA is having trouble meeting Oak Ridge power demands, and there's no surplus of power in the Northwestern part of the nation.

The site may include 200,000 acres, and AEC hopes to locate near a population center to avoid the headaches of further community planning and operation.

A 45-year old Nebraskan, Curtis A. Nelson, has been named manager of a new operations office set up for the project and presently located at AEC headquarters in Washington. Nelson, who was with the wartime Manhattan District, has been AEC's liaison officer at the Canadian Chalk River, Ont., atomic establishment.



Output Week Ended Aug 5—6,247,464,000 Kwhr

Weekly Output, Millions Kwhr

1950		1949		1948	
Aug	5 6,247	Aug	6 5,466	Aug	7 5,319
July	29 6,190	July	30 5,518	July	31 5,352
July	22 6,186	July	23 5,462	July	24 5,342
July	15 6,006	July	16 5,342	July	17 5,197
July	8 5,380	July	9 4,982	July	10 4,760
July	1 6,115	July	2 5,410	July	3 5,166
June	24 6,102	June	25 5,466	June	26 5,257
June	17 6,012	June	18 5,373	June	19 5,159
June	10 5,921	June	11 5,300	June	12 5,132
June	3 5,632	June	4 5,018	June	5 4,845

Percent Change from Previous Year

	Aug 5	July 29	July 22
New England	+13.8	+12.2	+13.1
Mid-Atlantic	+13.5	+ 9.6	+10.8
Central Industrial	+19.1	+14.6	+17.2
West Central	+12.3	+ 9.6	+ 9.7
Southeast	+14.4	+14.3	+17.1
South Central	+16.7	+14.0	+11.9
Rocky Mountain	+12.5	+13.7	+11.1
Pacific Coast	+ 8.5	+ 9.2	+ 9.1
Total United States	+14.3	+12.2	+13.3

MEETINGS

Illuminating Engineering Society
National Technical Conference, Hotel Huntington, Pasadena, Calif., August 21-24.

International Association of Electrical Inspectors
Northwestern Section, New Washington Hotel, Seattle, Wash., September 10-13.

★Edison Electric Institute
Accident Prevention Committee, Hotel Cleveland, Cleveland, Ohio, September 11-12; Electric Equipment Committee, Chamberlin Hotel, Old Point Comfort, Va., October 9-10; Transmission and Distribution Committee, Hotel New Yorker, New York, October 19-20; Meter and Service Committee, Robert Treat Hotel, Newark, N. J., October 25-27.

Northwest Public Power Association
Convention, Portland Hotel, Portland, Ore., September 13-15.

Conference and Exhibit
Sponsored by Instruments and Regulators Division of American Society of Mechanical Engineers and Instrument Society of America, Municipal Auditorium, Buffalo, N. Y., September 18-22.

Pennsylvania Electric Association
Annual Meeting, William Penn Hotel, Pittsburgh, Pa., September 19-20; Transmission and Distribution Committee, Irem Temple Country Club, Dallas, Pa., October 5-6.

American Society of Mechanical Engineers
Fall meeting, Hotel Sheraton, Worcester, Mass., September 19-21.

Public Utilities Association of the Virginias
Annual Meeting, Greenbrier Hotel, White Sulphur Springs, W. Va., September 22-23.

National Electronics Conference
Edgewater Beach Hotel, Chicago, Ill., September 25-27.

Canadian Electrical Manufacturers Association
Annual Meeting, General Brock Hotel, Niagara Falls, Ontario, Can., September 27-29.

Association of Edison Illuminating Companies
Annual Meeting, The Broadmoor, Colorado Springs, Colo., September 27-30.

★Southeastern Electric Exchange
Engineering and Operations Conference, Henry Grady Hotel, Atlanta, Georgia, September 28-29.

National Television and Electrical Living Show
Chicago Coliseum, Chicago, September 28-29, October 8.

American Institute of Electrical Engineers
Middle Eastern District Meeting, Lord Baltimore Hotel, Baltimore, Md., October 3-5; Fall General Meeting; Skirvin Hotel, Oklahoma City, Okla., October 23-27.

★Rocky Mountain Electrical League
Annual Convention, Broadmoor Hotel, Colorado Springs, Colo., October 8-11.

Indiana Electric Association
Annual Convention, French Lick Springs Hotel, French Lick, Ind., October 11-13.

★Iowa Utilities Association
Management Conference, Fort Des Moines Hotel, Des Moines, Iowa, October 16-17.

International Association of Electrical Leagues
Annual Conference, Copley Plaza Hotel, Boston, Mass., October 11-14.

National Electrical Contractors Association
Annual Convention, Hotel Biltmore, Los Angeles, Calif., October 17-20.

National Farm Electrification Conference
Melbourne Hotel, St. Louis, Mo., October 18-20.

★Wisconsin Utilities Association
Electric and Gas Section, Schroeder Hotel, Milwaukee, Wisconsin, November 8-10.

National Electrical Manufacturers Association
Chalfonte-Haddon Hall, Atlantic City, N. J., November 13-16.

★New Jersey Utilities Association
Annual Meeting, Seaview Country Club, Absecon, N. J., November 17-18.

★Addition this week.

Transmission Line OK'd

A contract has been authorized for construction of the final section of the Bureau of Reclamation's 600-mile transmission loop in North Dakota. The system will link Garrison Dam, now under construction, with the Central Power Cooperative, which is building a steam plant in central North Dakota.

Moves Headquarters

Northwest Electric Power Cooperative, which has been operating temporarily from Savannah, Mo., has moved its headquarters to Cameron, Mo.

WASHINGTON COMMENT

RONALD D. ROSS

PREPARING to meet the demands of mobilization, the electric utility industry also is facing another challenge: a new drive by federal power planners and public power advocates.

Already the first blasts have been fired in a new campaign to win the war—or the peace—with federal power. Thus far, it's been familiar cries from familiar sources but there will be more. Valley authorities and other far-reaching public power schemes will be hailed as the weapons for waging the fight for increased productivity. The prologue to the new campaign came on the heels of President Truman's first call for economic mobilization.

Forty-eight hours after the President's message on Korea, Congressmen asked Commerce Secretary Sawyer about the national power supply. "There still isn't enough," was his reply. The "power shortage" theme will be echoed in the weeks and months to come, as government power project plans are pressed for defense.

A few days after Sawyer's comment, the President himself accused New England of being asleep at the switch powerwise. It was the same Fair Deal argument, of course, that New England is the only region without big federal power developments. But the Truman statement to a press conference has a deeper meaning. It shows that the political campaign to build federal power projects in New England is still very much alive. And if the Administration is going to continue with its New England campaign, it is certainly in no mood to curtail expansion in other areas where federal power is already in operation.

Most blatant use of the Korean situation in the interests of further federal power expansion came from the Administration's Columbia Valley Authority salesman, Assistant Secretary of Interior C. Girard Davidson.

No firm estimates had been made of how much power would be needed for what jobs in the mobilization, but Davidson was ready to solve unposed problems with CVA. In a speech at Pendleton, Ore., he said that CVA would speed up the federal program on the Columbia.

"Now that defense needs begin to press on us, the delays in the federal river development program in the Northwest become even more apparent—and more dangerous," Davidson appealed.

Aluminum plants in the Northwest can't expand production "unless they get more low-cost power," he argued. CVA could bring power in sooner, beecause it would have some funds for starting construction of authorized projects without the "delays" entailed in going to Congress for funds, Davidson indicated.

It was no mere plug for CVA. The Administration spokesman lashed out with a bitter attack on the private industry and other opponents of the valley authority scheme. He did not, however, include the most important CVA foe: Congress, which has steadfastly refused to get excited over CVA, despite appeals from Davidson and other Fair Deal leaders.

Talk from Administration circles thus far makes it clear that it's still "politics as usual" with the federal power planners. For the present, mobilization is to be exploited as a new argument for government power projects.

This attitude comes as a disappointment to the industry as well as others. Even partial mobilization of the nation's power resources can make some severe demands. And the job ahead looks to be one that's going to take the best cooperative efforts of everyone. Domestic bickering by political opportunists is out of line when the nation is imperiled abroad.

Despite this, the industry cannot ignore attacks by government. It can hope that this ill-advised sniping will be tempered by a growing realization of what must be done to survive in an unpeaceful world. Thus far, however, there's been no truce in federal power's battle with the electric utility industry.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Britain's atomic piles at Harwell are producing tracer isotopes for some 23 European-nation medical professions.

Nuclear power is still some 10 years away according to Sir John Cockcroft, director at Harwell; one more year of research experimentation, three or four to build the atomic power plant and five to perfect the operation.

Heat transfer from the uranium "rods" to whatever liquid medium is circulated (to transfer the heat energy to the prime movers) is one of the key problems prolonging the development period.

Bepo, Harwell's graphite-moderated low-energy experimental pile is air-cooled by large exhaust fans which discharge the wasted heat up a 200-ft stack.

Rod shapes, compositions and containers are continually being changed in the direction of optimum performance.

Nuclear reactors, however, must be operated at considerably higher temperatures than any now known before they can be the basis for a practicable power plant.

Power from nuclear reactions would not, in the opinion of the British, be economically feasible unless price of customary fuels should "rise sharply."

SERVICE LIFE of transformer oil is determined in the laboratory by accelerating its deterioration in special cells like these

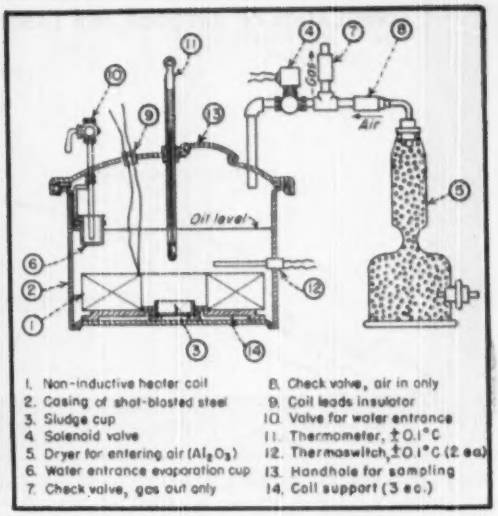

Gas
Air
Oil level
1. Non-inductive heater coil
2. Casing of shot-blasted steel
3. Sludge cup
4. Solenoid valve
5. Dryer for entering air (Al_2O_3)
6. Water entrance evaporation cup
7. Check valve, gas out only
8. Check valve, air in only
9. Coil leads insulator
10. Valve for water entrance
11. Thermometer, ±0.1°C
12. Thermoswitch, ±0.1°C (2 ea)
13. Handhole for sampling
14. Coil support (3 ea.)

FIG 1—LABORATORY CELL deteriorates transformer oil at accelerated rate by subjecting it to cyclic heating and cooling

Oil Life Measured in Six Months By New Deterioration Cell

Accelerated test predetermines service life characteristics of transformer oil in six months. Results correlate with those obtained in four year test

MARTIN I. ZWELLING, Chief Laboratory Engineer
Line Material Co, Zanesville, Ohio

SERVICE life characteristics of transformer oil that formerly required upwards of seven years to establish by conventional test methods can be accurately determined in six months by a new accelerated test developed at the Zanesville, Ohio, laboratories of the Line Material Co.

The test—which simulates oil deterioration under field service conditions—involves the cyclic heating and cooling of oil samples, between 40 and 100 C, under controlled conditions, in a specially-designed deterioration cell.

Results of the test show good correlation with long-term tests traditionally accepted as accurate gages of the performance of transformer oil under field service conditions. Usefulness of the new test is seen to lie in its ability to predict, with some element of accuracy, what will occur when an untried oil is proposed for service.

Long a Problem . . . Predicting the performance of transformer oil in field service has been a stubborn problem to transformer manufacturers, utility and petroleum engineers virtually since the first oil-filled transformers were used.

Investigators seeking a test for service life of oil have pursued divergent courses. Some have focused on a particular deteriorating agent of the oil as the mainspring causing deterioration, and tried to measure its effect. Others, of a more empirical cast, have accepted a general deterioration process and attempted to simulate field service conditions in their experiments.

Out of their investigations have come a variety of tests. All of them have been justified since they have been guideposts in developing solid insulations for oil-filled transformers. But the fact remains that the industry is still without a reasonably short-term deterioration oil test that will predict the life of transformer oil in actual field service.

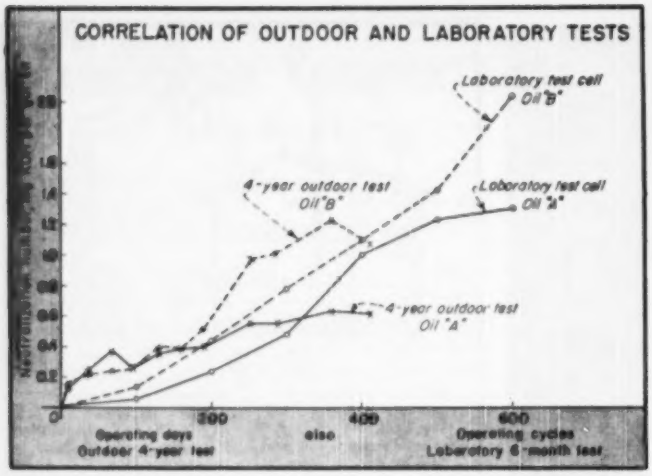


FIG 2—CORRELATION OF DATA obtained from 4-year outdoor test in stock transformer and 6-month test in deterioration cells. For outdoor test, time scale is operating days at one cycle per day; for laboratory test, scale is operating cycles at 100 cycles per month

True, a long-term test developed by Socony-Vacuum Oil Co* does deteriorate oil at a faster rate than actual service conditions, yet over a period long enough to predict what may occur in service. However, the test does require from 5 to 7 years. This is a long time to wait for the evaluation of an experimental oil.

On the other hand, those tests that complete deterioration in the very short time of a few weeks or less do not represent what actually occurs in service. Primarily they indicate *differences between oils* under test conditions. In all its investigations of the life properties of transformer oils, Line Material has shied away from short term tests. The feeling is that they do not measure properties of oil known to have a direct influence on the operation of a transformer.

On the other hand there have been investigations that used tests like the ASTM Total Acid Number which in itself has a direct bearing on transformer performance, and Interfacial Tension Test which is useful since it is a precision test indicating the time when an oil will sludge—a fact that has an obvious bearing on transformer performance.

A Service Test . . . After first trying out some of the short-time tests, we cautiously approached the problem with a slower method similar to that of the Socony-Vacuum Oil Co. (This test energized stock transformer with the lid slightly raised and the top oil temperature controlled at 85 C continuously for a five to seven year period.) Our approach was to submit several commercial transformer oils, in stock transformers, to an outdoor cycling procedure of 16 hr "on" and 8 hr "off" per day at approximately 300% load so that the top oil temperature varied with the weather between 95 and 100 C.

In addition to the cycling procedure, the gas portion at the top of the transformers was vented twice a day, once when the transformers were turned off at top temperature and again when they were turned on at the bottom temperature.

This test was continued for four years. It resulted in data that was considered to be reliable in predicting what each test oil would do in transformer service.

However, such a long-time procedure obviously would not divulge usable information in a reasonable time. Accordingly a special deterioration cell and test method was devised, that could be done in a laboratory. It was patterned after the outdoor test, but was faster. The hope was that at the completion of both tests there would be good correlation between the two. If this was the case, we would then have a service life test capable of providing meaningful information in a reasonably short time.

The Laboratory Cell . . . Details of the laboratory deterioration cell developed and used at Zanesville are shown in Fig 1. Components of the cell as indicated by the numbers on the drawing include:

1. Non-inductive heater coil.
2. Cell casing, shot-blasted inside.
3. A sludge bottle for measuring the sludging rate.
4. A solenoid valve to control air flow into and out of the cell.
5. Drying bottle with activated alumina to dry incoming air.
6. Cup, suspended in oil, evaporates water during each heating cycle. Gives any desired moisture condition in gas chamber above the oil.
7. Check valve allows gas to pass into atmosphere only.
8. Check valve allows air to pass into cell only.
9. Insulating bushing for coil leads.
10. Valve for admitting water to evaporating cup.
11. Thermometer, accurate to 0.1 C, for checking apparatus daily.
12. Thermoswitches, two each, accurate to 0.1 C, to control operation of coil and solenoid valve through relays.
13. Handhole cover for handling samples.
14. Supports for the heater coil.

The standard heating period requires about two hours for top oil to rise from 40 C to 100 C. The full cycle of heating and cooling, takes about five hours. Approximately one month is needed to complete 100 cycles.

The test cell is completely automatic. Thermoswitches (12 on Fig 1), the coil (1) and the solenoid valve (4) operate together as follows:

1. Below 40 C the heater coil is energized and the solenoid valve open. As the bath heats up, the solenoid closes at 40 C and stays closed until the bath reaches 99 C. Then the solenoid valve opens and the coil is de-energized. Temperature overshoot lets oil temperature rise to 100 C, since pressure mounts in the cell during the heating period and gases pass out to atmosphere through the exhaust check valve.

2. Through overshot, the bath holds top temperature. This keeps

* See ELECTRICAL WORLD August 3, August 17, and August 31, 1946.

the solenoid valve open long enough to expel gas and relieve internal pressure.

3. As the bath cools, the solenoid valve closes at 99 C but the coil remains de-energized. During cooling a vacuum is formed inside the cell as oil volume decreases and vapors condense. At 40 C, the heater coil is re-energized and the solenoid valve opened.

4. Again through overshoot the bath holds the low temperature and the solenoid valve stays open long enough to suck in dry air through the check valve (8).

5. The cycle is automatically self-repeating. Bath temperature is held to limits of 40 C and 100 C by checking the accuracy of the thermoswitches daily against a thermometer (11).

6. Air entering the cell is first dried by passing through activated alumina (5).

7. 1¾ gal of oil is required per test. No additions are needed to compensate for loss due to sampling.

8. Rate of deterioration is checked periodically by measuring neutralization or total acid number of the oil and percent sludge contained in the sludge bottle (3), as will be explained.

Humidity Control . . . The test cell is closed tightly with provisions for removing oil vapors and bringing in new oxygen with air, once every cycle—as explained. The amount of water to be dropped into the evaporating cup (10) as a contaminant of the gas chamber is computed from the relative humidy desired at any arbitrary temperature. Enough water is added once a day, based on the number of cycles completed since the last addition, to hold conditions imposed at the start of the test. We used 25% relative humidity at 38 F.

This way of producing moisture above the oil is not completely satisfactory since moisture is not added at a pre-determined rate over small enough increments of time or cycles. It would be better if the addition of moisture was equally distributed with every cycle completed. But the method does, on the whole, impose conditions met in field service. Moreover they may all be varied according to any particular locality or curiosity. In addition to this, the test is of such duration, and the imposed conditions are sufficiently like actual condition in the field that the resulting data can be correlated with field service. The deterioration characteristics of an oil for field service are evaluated from the slopes and final heights of the acid number and sludge curves obtained over 600 cycles of operation or conventional oils. This is extended to the necessary number of cycles to show deterioration rate after loss of inhibitor when testing inhibited oils. The condition of the insulation, internal cell casing and other parts made of transformer materials influence judgment.

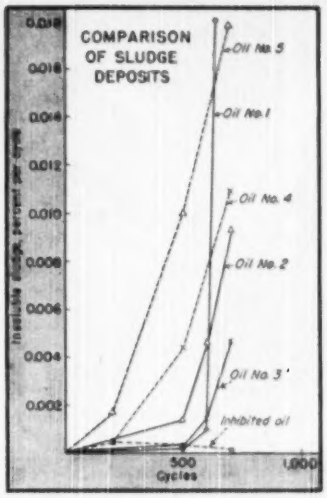


FIG 3—SLUDGE deposited from five conventional commercial oils in laboratory cell. Shown also is performance of an inhibited oil with sludge found by gravimetric analysis

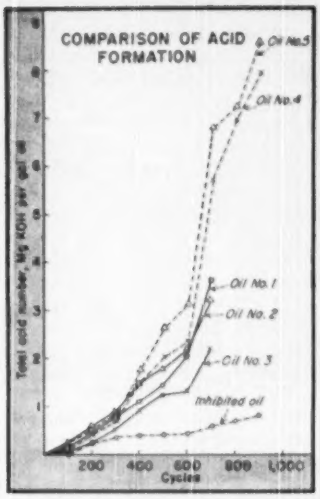


FIG 4—TOTAL ACID formed by the six oils of Fig 3 during accelerated test in a deterioration cell. Acid number is designated by the new ASTM method

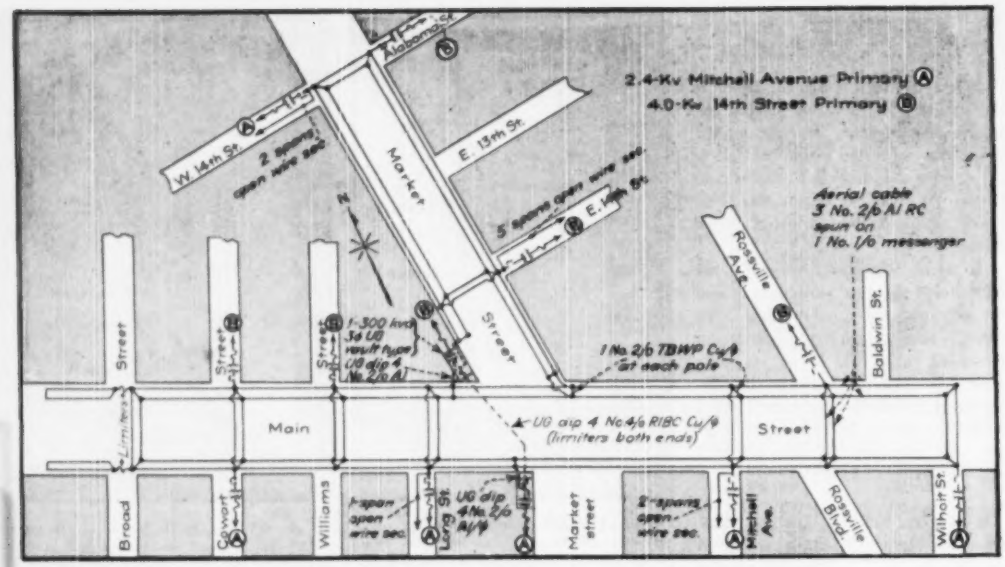
Correlation of Test Results . . . Representative of the correlation of test results with field service are the curves of Fig 2.

These curves compare data obtained from the four-year outdoor test, described earlier, with that obtained from the new laboratory deterioration cell described. Sampling periods and no-load periods were included in the four-year test period. The operating days of outdoor test are actual individual daily load cycles. No attempt was made to adjust the curves. They simply show the relationship of the methods based on the number of cycles performed in each test procedure. The curves of the outdoor test are not as smooth as the better-controlled laboratory test, but they exhibit the same trend of deterioration rate.

It is interesting to observe the manner in which five commercial non-inhibited oils performed under the deterioration cell test. These curves are shown in Fig 3 and 4, the numbers corresponding to the same oil in both instances. Note the difference of quantities measured by the ASTM colormetric method labeled "Neutralization Number," Fig 2, and the newer ASTM Electrometric Method labeled "Total Acid Number," Fig 4. Deterioration rate of both the four-year outdoor test and the first operations of the laboratory six-month test were measured by the old ASTM Procedure D-188, Neutralization Number. Later, ASTM tentatively changed their acid test procedure to D-664, Total Acid Number, which is more accurate and precise for dark used oil. The new procedure obtains much higher readings than the old test for the same degree of oil deterioration.

It is appreciated that the new procedure outlined is not the complete answer to determining all oxidation

(Continued on page 164)



AERIAL CABLE SECONDARY NETWORK is grid of two 2/0 conductors per phase, on each side of street, fed from 12 transformer locations on side streets. Feed is from two primaries; one 2.4 kv feeding at points (A), one 4 kv feeding at points (B)

Postpone Costly Underground with Aerial

Improved appearance and more capacity in secondary business district. Single conductor, 2/0 aluminum secondary cable is insulated for 600 v and spinner-installed

GEORGE R. PARKER, Chief Engineer; W. A. CAMPBELL, Associate Engineer and F. J. BAKER, Underground Engineer
Electric Power Board of Chattanooga (Tenn.)

IMPROVED APPEARANCE and increased capacity with an aerial cable secondary network have made it possible to postpone costly underground in a secondary business district of Chattanooga. By building the network on the street, expensive rerouting of services was avoided.

Fed by 12 transformer locations, the secondary network incorporates several unusual features. A wood pole line was built on each side of the street. These lines provide for the secondary grid and street lights.

For the secondary grid, two 3/C No. 2/0 aluminum aerial cables were installed on each pole line. This provided two conductors per phase on each side of the street. Corresponding phase conductors on the same side of the street were tied together at each pole and ties were made between corresponding phase conductors on opposite sides of the street at each cross street intersection. Ties at each pole were No. 2/0 copper jumpers to hold burn-off impedance to a minimum. This limited the longest possible run of single-conductor cable that could be involved in a short circuit to one span, or 100 ft, and assured a minimum of three conductors feeding into the faulted conductor.

Cluster-Mounted Transformers . . . Transformers were located on side streets. Ten installations were cluster-mounted overhead. These consisted of 3 50-kva transformers each. At the point of heaviest load two installations of 300 kva each were made in underground vaults. Each transformer installation feeds into the aerial secondary network at the nearest point.

Single-conductor, 2/0 aluminum secondary cables were insulated for 600 v, having 5/64 in. of heat-resisting rubber compound with a 3/64 in. color-coded Neoprene jacket. To get two conductors per phase on each side of the street, three cables, one per phase, were attached to each of two parallel No. 1/0 bare copper messengers by the spinner method. Messengers were fastened on opposite sides of each side of the pole by three-bolt

TWO AERIAL CABLES on each side of Main St comprise three 2/0 aluminum conductors lashed together on 1/0 copper messenger. Both old and new construction are visible

Cable Secondary Network

clamps on opposite ends of a double-arming bolt. The 1/0 copper messenger was selected because a sufficient amount was available in stock and it is a non-standard conductor size on the Chattanooga system. It had sufficient mechanical strength and current carrying capacity to serve as the neutral. Since it had been in service, no pre-stressing was necessary. If this surplus conductor had not been available, Copperweld messenger would have been used for the job.

Design of the network system was based on two primary feeders, one 4 kv and one 2.4 kv, which were available in the area. While a third feeder would have improved the ratio of installed transformer and protector capacity to peak load, it could not be justified at this time. With this two-feeder supply, the emergency loading on the transformers remaining in service with one feeder off was limited to 200% of their rated capacity. The 4-kv and 2.4-kv feeders supply other radial loads whose effect on the primary regulation had to be considered for both normal and emergency operation.

The area is adjacent to one of the main railroad stations and is about a half mile from the principal business district. Load is 0.3 kva per lin ft of street and is expected to reach a value of two or three times this figure within the next five years.

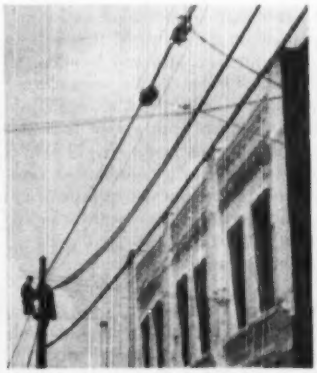
The old distribution was radial type and was inadequate to supply the growing load. Most of the poles, fixtures and conductors were badly deteriorated so the area needed a complete rebuilding.

Why Network Was Picked . . . Before the aerial cable was decided upon various types of distribution that might be used were investigated. Three were considered:

1. An underground network.
2. An overhead radial system built in alleys.
3. An aerial cable network built along the streets.

A comparison shows that an underground system would cost about three times an overhead. It also showed that a network could be built along

SPINNER used in lashing conductors to messenger in the field is loaded with No. 10 Copperweld lashing wire

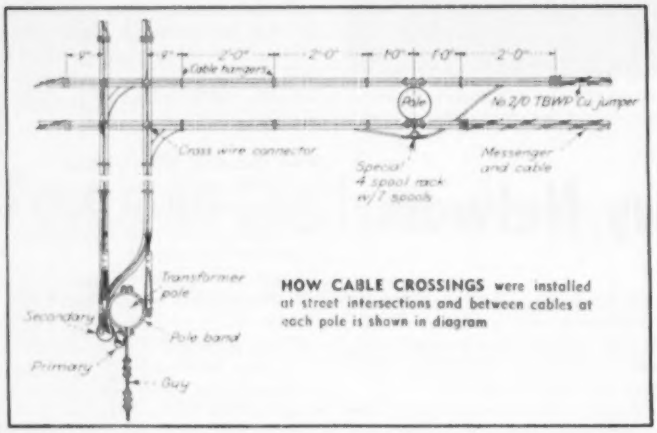


OBSTRUCTIONS in the form of services, both power and telephone, were a frequent obstacle to cable spinning progress

LADDER TRUCK was most useful in getting cable spinner past obstructions, in this case a service across the street

BEFORE aerial cable secondary network was installed unsightly open-wire junction poles like this one were common

AFTER removal of open wire and installation of aerial cable, appearance and quality of service in downtown area were improved



HOW CABLE CROSSINGS were installed at street intersections and between cables at each pole is shown in diagram

the streets slightly cheaper than a radial system in the alleys, due to the expense of turning customers' services from the front to the rear of the buildings. The aerial network was selected due to the saving over an underground system and its advantage over a radial system both from the standpoint of adding future load and the ease of transition to an underground system when and if the load justifies it.

Total load in the area measured 1,050 kva with densities ranging from 0.2 to 0.5 kva per ft. In order to improve the general appearance by avoiding the installation of transformers on the two principal streets, the design decided upon is limited to 0.8 kva per ft or $2\frac{2}{3}$ times the present load, due to the number and location of side streets where transformers could be installed. This loading can be increased by adding transformer stations on the principal streets.

The number, size and location of the transformer banks were determined not only from a regulation standpoint, but with a view to burn-off capacity as well. The 150-kva transformer banks coordinated very closely with the burn-off requirements of the secondary conductor selected and this size bank also lent itself to efficient transformer loading.

Basis For Design . . . In the design of a secondary grid, regulation and fault clearing were considered of equal importance. The secondary conductor selected had to satisfy both requirements. With an assumed load unbalance of 15% the spread between the highest and lowest voltage was limited to 6%, 7.2 v, during normal operation. This was increased to 10%, 12 v, with one feeder off.

The conventional method of installing secondaries on racks was compared with the use of aerial cable. Superior qualities of aerial cable from both the standpoint of regulation and burn-off requirements were demonstrated by a few preliminary calculations. Calculated impedance for the same size conductor was about 60% greater and the voltage drop 40% greater when mounted on racks than when in the more compact form of aerial cable. Thus, for the same voltage drop a conductor one to two sizes smaller could be used for the aerial cable. This reduction in conductor size has little if any economic advantage, because the aerial cable necessitates a more expensive insulation. The smaller cable does, however, reduce the short circuit current necessary to clear faults, and this was an important consideration in the grid design. The neat compact appearance of the aerial cable was another factor that led to its adoption.

A preliminary solution of the network was worked out using one No. 4/0 conductor per phase on each side of the street with the 12 banks of transformers shown on the wiring diagram. Regulation was satisfactory, but the short circuit current required to burn off a No. 4/0 conductor could not be delivered to all parts of the grid. Some thought was given to the installation of current limiters in the

conductors but this idea was discarded in favor of the multiple circuits of a smaller conductor that could be cleared with the short circuit current available.

While this increased the cost of the secondary grid, such a marked reduction in the impedance could not be obtained in any other way and there was the added advantage of a reduction in the voltage drop. Another important consideration was the closer coordination of the burn-off current of the smaller conductor with its insulation damage characteristics and with the ASA short-time loading of the 50-kva transformers.

The grid installed, with two No. 2/0 aluminum conductors per phase on each side of the street, gave voltage regulation approximately the same as for one No. 4/0 conductor. The short circuit current available was not only ample for clearing the secondary conductors, but also for blowing the protector fuses should any fail to open on reverse current due to primary faults.

Aluminum conductor was selected because the price of aluminum at this time was particularly favorable, compared to copper. Also, the burn-off ability of No. 2/0 aluminum was some 15% better than the 2/0 copper.

Calculating Board Study . . . At this stage in the design, the complete network, including the primary feeders and their radial loads, was set up on the dc calculating board. The system was then thoroughly analyzed both from a regulation and a fault clearing standpoint.

One of the things brought out in the calculating board study was the desirability of maintaining a 2% voltage differential between the first transformer on the 4-kv feeder and the first transformer on the 2.4-kv feeder. In some places the calculating board indicated an unequal division of load between adjacent transformers of opposite feeders. This was due to the routing of the primary feeders, and the greater spread between the primary voltage at the first and the last transformer on the 2.4-kv feeder.

Reduction in the voltage spread could be expected if both feeders were 4 kv. This proved to be true when a 4-kv feeder was substituted for the 2.4 kv on the calculating board. This in turn resulted in a reduction in the secondary voltage spread of about 10%. Therefore, as the network load grows it will be desirable to change the lower voltage feeder to 4 kv.

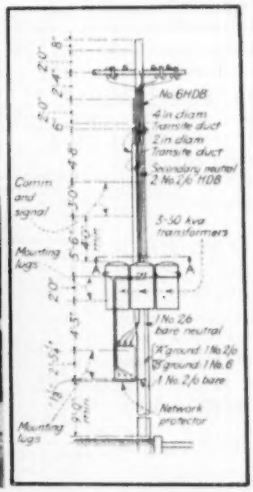
The calculating board was also used to check the transformer loading and regulation with either of the primary feeders off. Both proved to be within the design limits. The board also demonstrated adequate burn-off capacity on the secondary grid except in the radial section on the west end. Current limiters were installed to take care of this section.

The network protector installed was the newly developed Type Mg-13.

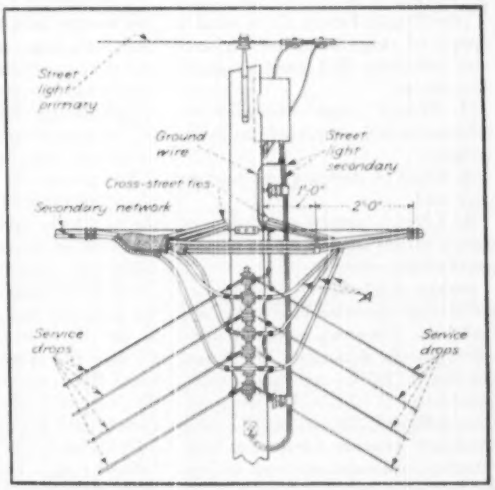
Standard 1,200-amp submersible network protectors were installed on the two 300-kva vault-type units and mounted directly on the transformers. Due to the possibility of frequent protector operations, especially at light load, a type PYC overcurrent relay was added for non-sensitive reverse current tripping. With the electrical restraint on the CAN relay together with the PYC relay, protector tripping can be controlled for any reverse current from 10 to 100% of the protector rating.

Protectors are fused with the alloy-type NF-1 fuses, the time current characteristics of which follow closely the ASA short-time loading curve of the transformers. The high side transformer fuses offer very little if any protection, but are designed to take the transformers off the line without a relay operation at the substation in case of transformer failure.

To assure stable regulator operation the "X" (reactance) elements in the compensators of the regulator's contact-making voltmeter were reversed, causing a voltage rise instead of a voltage drop.



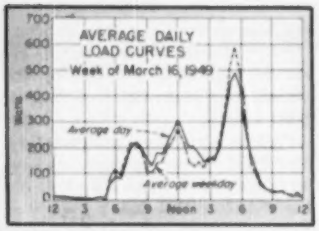
TRANSFORMERS are mounted in clusters on poles on side streets with network protectors below. In this case transformers are 50-kva units. Secondary cable feeding into network is connected to cables on both sides of street forming a cross tie. Drawing shows details



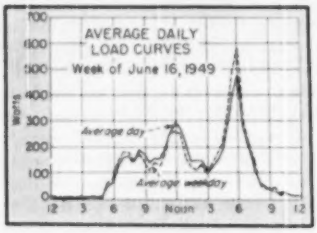
PHASE CONDUCTORS of the parallel aerial cables were tied together at each pole with 2/0 copper jumpers (A) looped through four-spool secondary racks mounted on building side of the pole. Services were connected to these jumpers

Preliminary Report on

Group coincident maximum demand was 0.7205 kw per range and non-coincident maximum demand 2.498 kw in March 1949. Estimated yearly use, 1,219 kwhr



DEMANDS for average weekday were slightly higher than for average day, for average customer during week March 16-22, 1949



MAXIMUM DEMAND came at 6:00 pm in June as shown by load curves for the average customer for June 16-22, 1949

F. A. COMPTON
Vice-President and Sales Manager
and
C. R. LANDRIGAN
Controller
The Detroit Edison Co, Detroit

IN ORDER to determine the characteristics of the electric range load the Detroit Edison Co selected a sample of range customers for tests and interviews that were aimed at determining:

1. Electric range investment requirements and comparing them with revenue.

2. Effect of electric range load on peak load.

3. Effect a greater saturation of electric ranges would have on present installed capacities.

Results of this survey indicate that the average connected load of a range is 10.1 kw. The group maximum coincident 30-min demand in the March test was 0.7205 kw per range, a demand factor of 7.13%. This occurred from 5:00 to 5:30 pm on Monday. Maximum demands for Detroit and suburban customers occurred during the half-hour period ending at 5:30 pm in March and 6:00 pm in June, but at 11:30 am on Sunday for the average farm customer.

Load factor was 19.07% for the average day or 22.92% for an average week day during the March test period.

The non-coincident maximum demands had a value of 2.498 kw per range during the March test period.

Load curves for the average day and average week day from the March and June tests and the 7-day load curve for an average customer for the March and June tests are shown in the accompanying charts.

The average yearly energy use of an electric range is about 1219 kwhr.

Energy use of 215,920 ranges is about 263,206,480 kwhr or 18.1% of the total kwhr sales.

A random sample of electric range customers was obtained by selecting every 850th customer in Detroit and the suburban and rural areas served by the company. Those having two-wire service were eliminated, and every third customer having three-wire service was selected for interviewing and metering.

Record and Type G 30-min interval demand meters were installed on 72 residential electric ranges in Detroit and outlying homes. To provide a representative sample for the farm customer, the percentage of meters placed on farm ranges is greater than the distribution percentage of ranges on farms.

	Range Customers	% of Total Range Customers	Test Meters Set	% of Total Test Meters
Detroit	70,435	32.6	20	27.8
Suburban	124,654	57.7	36	50.0
Farm	20,831	9.7	16	22.2

Demand and energy data were obtained for an average Detroit, suburban and farm customer. The data for each of the three types of customers were then projected out in the ratio

TABLE I—Characteristics of the Range Load

Demand Test Periods	
March 16 — March 22, 1949	
June 16 — June 22, 1949	
November 1948 to August 1949	
Number of Ranges in Use	215,920
Number of Ranges in Test	72
Connected Load of Average Range*—kw	10.1
Use Per Range—kwhr	
Per Day**	
Yearly Average	3.34
March Average	3.48
June Average	3.21
Per Average Weekday	
March	3.96
June	2.94
Per Year**	1219
Coincident Maximum Demand per Range	
(Integrated Clock Half-hour)	
Test Period—March	
Kw	0.7205
Day	Monday
Time of Occurrence—Period Ended	5:30 pm
Test Period—June	
Kw	0.6605
Day	Thursday
Time of Occurrence—Period Ended	6:00 pm
Average Weekday—March	
Kw	0.5853
Time of Occurrence—Period Ended	5:30 pm
Average Weekday—June	
Kw	0.5761
Time of Occurrence—Period Ended	6:00 pm
Non-Coincident Maximum Demand per Range—Kw	
March	2.498
June	2.5474
Load Factors—Percent	
Based on Group Maximum Demands	
Test Period—March	19.07
Test Period—June	18.32
Average Weekday—March	22.92
Average Weekday—June	21.26
Based on Non-Coincident Maximum Demands	
Test Period—March	5.50
Test Period—June	4.75
Demand Factor—Percent	
Test Period—March	7.13
Test Period—June	6.54
Average Weekday—March	5.80
Average Weekday—June	5.70
Coincidence Factor—Percent	
Test Period—March	28.8
Test Period—June	25.9
Average Weekday—March	25.3
Average Weekday—June	23.7

* Based upon distribution of ranges in Detroit, suburbs and farm.

** Based upon record meter readings for 9 months.

Range Load Characteristics

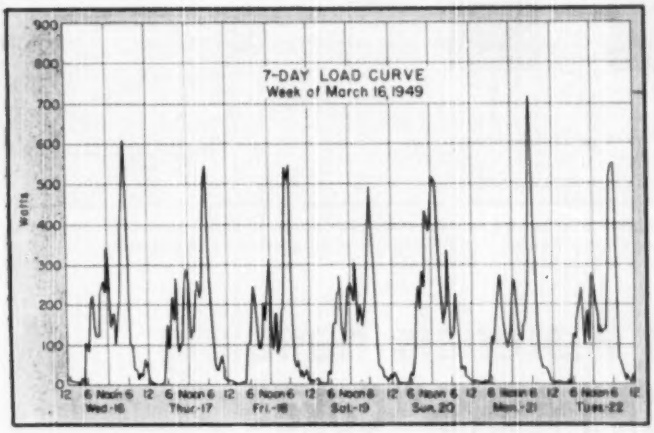
of actual range distribution to obtain demand and energy data for the average customer.

Studies were made of characteristics of families and homes where test meters were set. The average family size was 4.09 persons (including 0.26 infants) as compared to 3.97 for the average home in the company area. Income distribution is representative of customers as a whole.

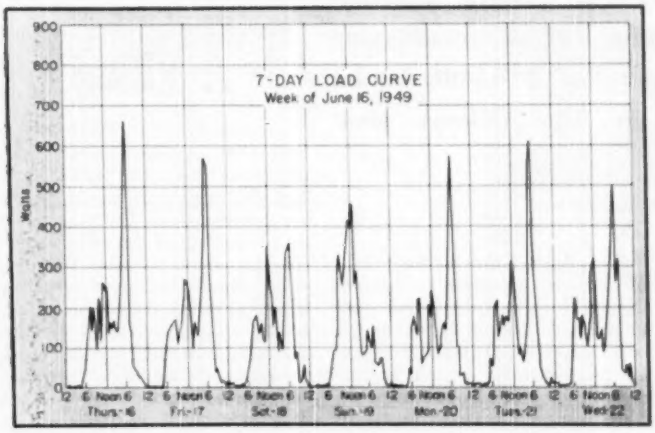
Medium sized, five-to seven-room homes, made up 68% of those tested. Sixty-five percent of tests were in the middle income group. Other pertinent data, including appliances owned, are given in Table II.

Kilowatthour readings were taken from the regular meter and the range meter semi-monthly. Every three months, half-hour demands were charted for a period of two weeks.

Kilowatthour readings, beginning Nov. 1948, continued through 1949.



MAXIMUM DEMAND of the average customer in March came on Monday between 5:00 and 5:30 pm as shown by average customer load curve for March 16-22, 1949



JUNE MAXIMUM DEMAND for the average customer came between 5:30 and 6:00 pm on Thursday as shown on this load curve for the seven-day period June 16-22, 1949

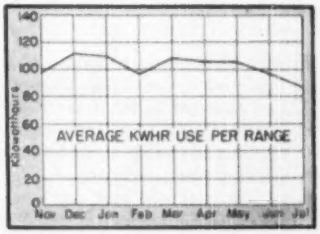
TABLE II—Characteristics of Test Groups

Total Sample	78
Average Family Size*	
Infants	0.26
Children	1.22
Adults	2.61
Total	4.09
Size of Dwelling Unit	
Small (under 5 rooms)	3.6%
Medium (5-7 rooms)	68.0
Large (over 7 rooms)	28.4
Average number of rooms	6.7
Family Income	
Upper	17.5%
Middle	65.1
Lower	17.4
Saturation of Other Major Appliances	
Refrigerator	99.4%
Washer—Non-automatic	81.3
Automatic	16.2
Ironer	25.3
Water Heater	16.6
Blower	13.8
Freezer	10.8
Clothes Dryer	9.6
Garbage Disposal	6.6
Dishwasher	3.6

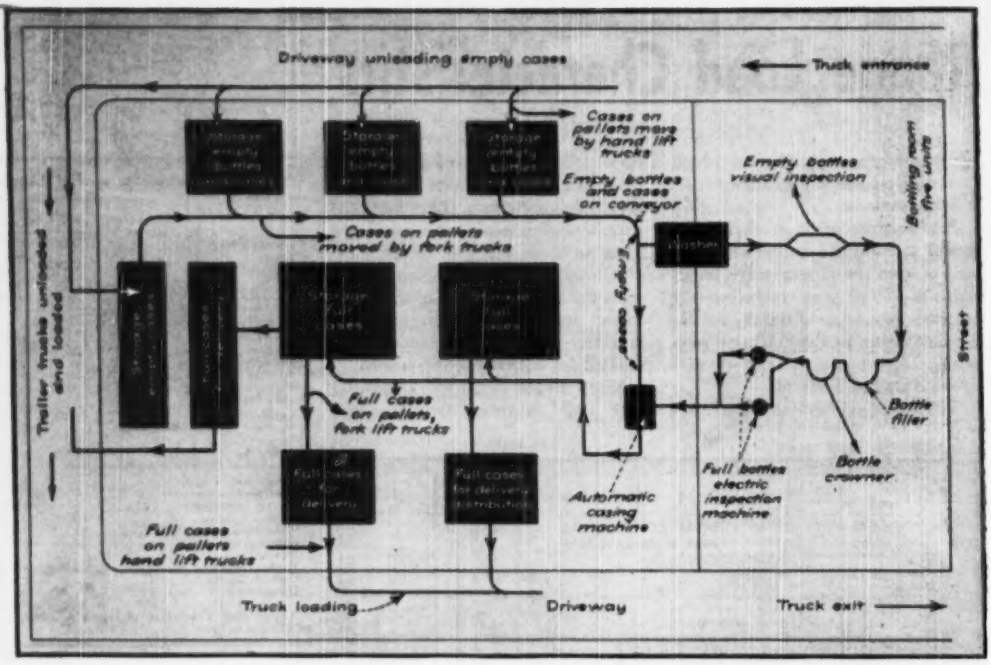
*Based upon distribution of ranges in Detroit, in suburbs and on farms.

TABLE III—Average Kilowatthour Use Per Range

Per Day	
November	3.26
December	3.60
January	3.52
February	3.46
March	3.48
April	3.53
May	3.40
June	3.21
July	2.79
Average	3.34
Per Month	
November	97.8
December	111.6
January	109.1
February	96.9
March	107.9
April	105.9
May	105.4
June	96.3
July	86.5
Average	100.8
Per Year	
Average	1,219



RANGES used an average of slightly over 100 kwhr per month, less 4 months of year



1 **FLOW CHART** of large New Orleans bottling plant having five bottling units with production capacity of 810,000 bottles of coke per day, made possible by modern materials handling methods used throughout. All units feed storage spaces shown

Modern Materials Handling Bottles More "Coke"

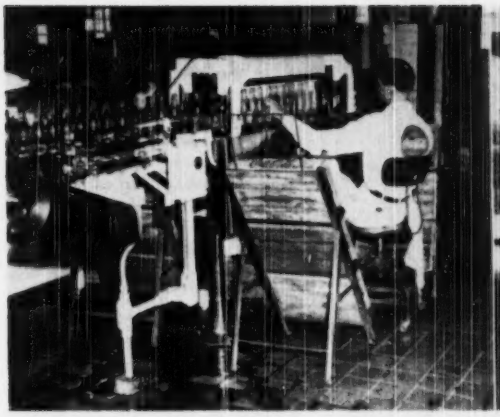
Mechanized materials handling, modern electrical distribution, planned lighting and air conditioning play major part in producing 810,000 bottles daily at prewar prices at New Orleans plant

I. R. **WEBRE**, Industrial and Commercial Div
New Orleans Public Service, Inc

THE NEW modern plant of the Louisiana Coca-Cola Bottling Company Ltd, in the New Orleans area, is said to be the largest and one of the finest of its kind in the bottling world. The plant, exclusive of driveways, entrances and parkway, occupies two full city blocks with 232,000 sq ft of building space.

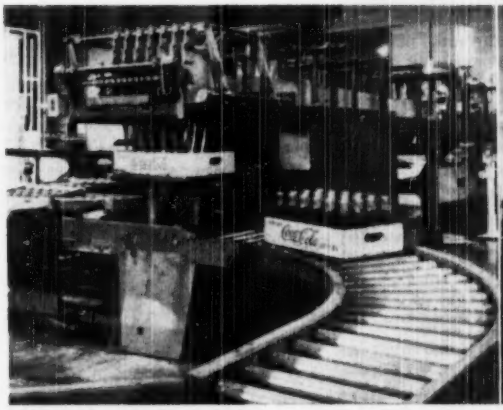
The nerve center of the plant is the bottling room. It has the newest type of equipment applicable to high production levels in order to take care of the large demand by the people of the City of New Orleans. This production center uses an area measuring 92 x 120 ft. In the area, there are five bottling units having a production capacity of 90,000 bottles per hr or about 810,000 bottles per day.

To make this enormous production figure possible, modern materials handling methods are used from the time that the cases with empty bottles are unloaded from incoming trucks to the loading of the filled bottles onto the out-going trucks. The speed of the electrically driven conveyors is synchronized with that of the bottling line served. The only hand operations required in the entire process are the loading of the empty bottles in cases onto the conveyor and the transfer of the empty bottles from cases to the bottle washer. This latter operation employs a special hand-

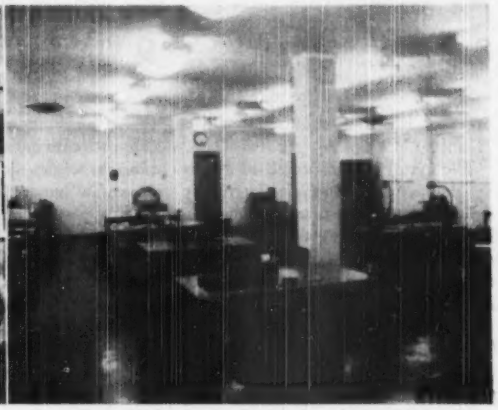


2 **INSPECTION LIGHT** for checking empty bottles enables operator to see easily any foreign particles, cracks, etc. Conveyor passes bottles in front of lighted board

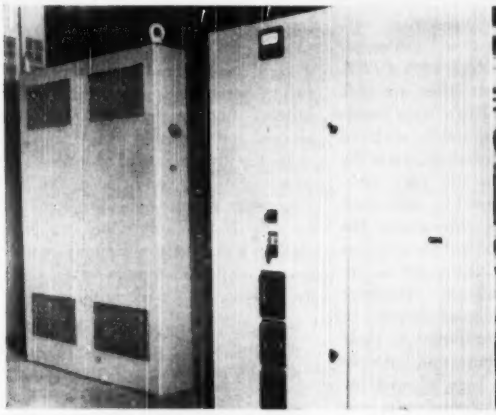
3 **BOTTLE INSPECTION** machines inspect filled bottles. Bottles found having any minute floating or suspended particle are removed from production line by an electronic mechanism



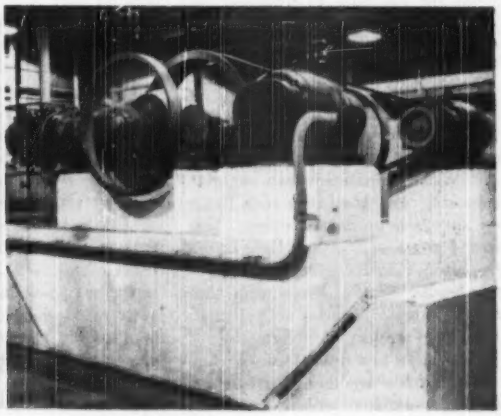
4 **CASE FILLER** and conveyor at end of bottling line. After casing, fork lift trucks pick up stacked cases and rush them to storage area. From storage they are distributed for delivery



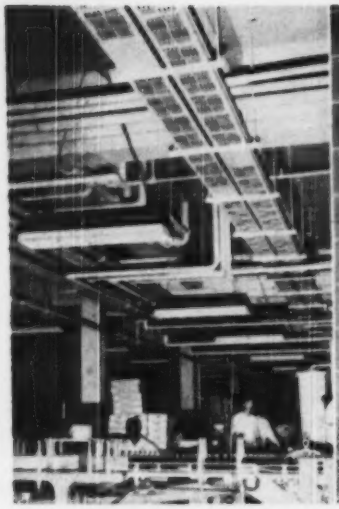
5 **OFFICE LIGHTING** intensity of 80 ft-c is provided by semi-direct shielded units each having 4 40-w fluorescent lamps. Walls, ceiling and floors have high reflection factors



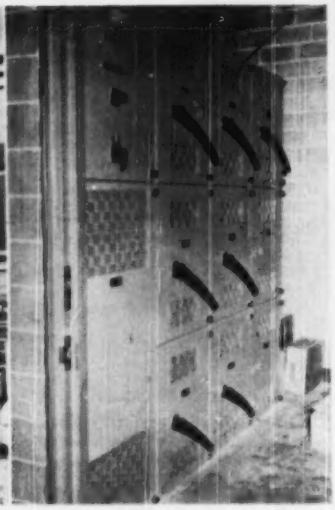
6 **UNIT SUBSTATION** has 750-kva, 13.2-kv to 120/208-v, 3-ph dry type transformer with totally enclosed circuit breakers



7 **AIR COMPRESSORS** driven by 50-hp motors supply air for plant. Note vibration damping under the base construction



8 BUS DUCT distribution provides for maximum flexibility, expansion and additional circuits without interference



9 MAIN DISTRIBUTION panel has dead front circuit breakers; it combines flexibility and streamlined appearance

operated lifting mechanism that lifts 12 bottles at a time.

The syrup is transported in drums by means of a special electrically driven drum lift conveyor from the loading platform to the third floor storage room. The syrup from the drums, after dumping, is fed by gravity to storage tanks used in connection with each of the bottling machines. One of the unique features of the bottling equipment employed is the pre-mix system in which the syrup and water are thoroughly proportioned and mixed, then carbonated and fed into the bottles. This eliminates the necessity of upending the individual bottles to insure thorough mixing of the ingredients.

After the bottles are filled and capped, they are then inspected by automatic inspection machines. These machines consist of a moving mechanism incorporating 10 electric beams in vertical formation which examine constantly and accurately each bottle on the fast production line. This strong group of beams of light in the inspection machine penetrates the entire bottle. Bottles containing any minute foreign particles are rejected. A selector mechanism diverts any rejected bottles to a reject table.

The bottles are then conveyed to the automatic case packing machines in single file, and in a matter of seconds are lined up by dividers into six ranks of four each, ready to be dropped automatically into the same cases in which they arrived as empties a few moments before at the unloading platform. After casing, fork lift trucks pick up the neatly stocked palletized loads of 56 cases each and transport them to the storage area from which they are later distributed and loaded on trucks.

The entire electrical requirements of the plant are served by a 13,200-v primary service. This service is brought in underground to a 750-kva unit substation located in a room adjacent to the bottling room where the greatest part of the electrical load is concentrated. The substation consists of a 3-ph dry type transformer with secondary voltage of 120/208. Completing this installation are both primary and secondary circuit breakers which are of the totally enclosed type. This type of installation was decided upon due to the very satisfactory results obtained in other similar bottling plants throughout the country. It also fulfilled the requirements of the local owner for an installation which affords maximum safety even when located directly in their building and adjacent to their greatest load concentration. Ample arrangements have been allowed for expansion as additional circuits can be added without interfering with those already installed.

As one would expect in a bottling plant of this type the major motor load is used in connection with the bottling equipment. In each of the bottling lines there is a 50-hp motor driving a 45-ton refrigeration compressor which is used to cool the premixed beverage. In each bottling unit consisting of soakers, conveyors, carbo-coolers, fillers, crowners, etc, including the aforementioned refrigeration compressors, there is a connected load of approximately 75-hp. The air requirements of the units are served by two 50-hp and one 25-hp air compressors. The total power load for bottling purposes is about 500 hp.

Equally as important as the production facilities described is the planned lighting installation throughout the plant.

The lighting in the bottling room consists of continuous rows—each with nine fixtures of 3 40-w fluorescent lamps in recessed troffer units with ribbed glass shields. The fixtures are so spaced as to give maximum intensity on the bottling lines of 70 ft-c. The average intensity over the entire room is approximately 35 ft-c. In the storage area — industrial, 3 40-w lamp fixtures are used. The average intensity is 20 ft-c.

In the office areas considerable attention was given to the reflection factors of the walls, ceiling and floors. All office equipment is of a light color and light absorption is kept to a minimum. The fixtures are 4 40-w semi-direct shielded units of the type designed to keep maintenance cost down. Average intensity is 80 ft-c.

The management fully realized the importance of keeping their lighting at designed efficiency and has placed a rigid maintenance schedule in effect. A weekly inspection is made for burned out lamps. Fixtures are cleaned and inspected each month.

In the five areas of the building which are air conditioned the refrigeration requirements are supplied by one 75-ton unit which supplies chilled water to the various conditioning units. The areas served have the following tonnage requirements:

First floor and lobby	5 tons
Second and third floor offices	37½ tons
Assembly room (seating cap. 250)	25 tons
Office personnel lunch room	7 tons
Production department lunch room	7½ tons

Need Operating Mistakes Accompany Economic Prosperity?

A 35% decline in mistakes following institution of a positive program indicates that mistake frequency need not follow economic ups and downs

V. O. BOLAND, Supervisor of Operating Instructions
System Operating Dept, Pennsylvania Power & Light Co

AN ALARMING increase in the number of operating mistakes by Pennsylvania Power & Light Co's dispatching and operating personnel during 1948 clearly indicated a dangerous downward trend in operating efficiency. This trend continued, and, as 1948 gave way to 1949, the operating mistake problem had become one of deep concern.

This situation was not only arrested, but operating mistakes in 1949 decreased 35% compared with 1948—despite a heavy construction schedule. Publicity within the company given this report, and the recommendations set forth in it, are felt to have been an important factor in this greatly improved record. Information for these recommendations was gained by turning back the pages of the company's operating history for exhaustive research and minute study of performance over a span of 25 years. The task at hand was to discover major factors responsible for the frequency of mistake occurrence, principal occupational conditions that breed mistakes, and the personal or psychological factors contributing most to a high mistake rate.

Statistical Findings and Interpretation ... A simple mistake curve (Fig 1) was plotted over the 25-year period to determine what bare statistics disclosed. Attention was immediately focused on the all-time high of 74 mistakes in 1924 and the all-time low of 16 mistakes in 1933, thus establishing the two extremes of the curve. Next, and very important, was the awareness of an almost rhythmic rise and fall of the curve.

Fitting known economic and industrial conditions of the corresponding years to the mistake curve revealed two definite cycles embracing the Depression '30's and the World War II periods. It was also evident that a singular association existed between mistake peaks and economic prosperity, and the mistake "lows" which conformed to periods of depression and national crisis.

Regardless of the prevailing economic condition, the mistake frequency rate is definitely influenced by the type and volume of field work as measured by the number of permits* issued. But, as indicated by Fig 2, work volume is not the controlling factor and not always a predominant one. During depression periods, repetitive work has the danger of becoming too mechanical, and this causes mistakes. We must also consider that nature does not relent, and sleet, lightning and wind continue to contribute mistake possibilities. Despite the fact that possibilities did abound, the depression valley re-

* A "permit" is the permission granted by a System Operating (Dispatching) authority to work on equipment after special precautions have been taken to protect the men doing the work.

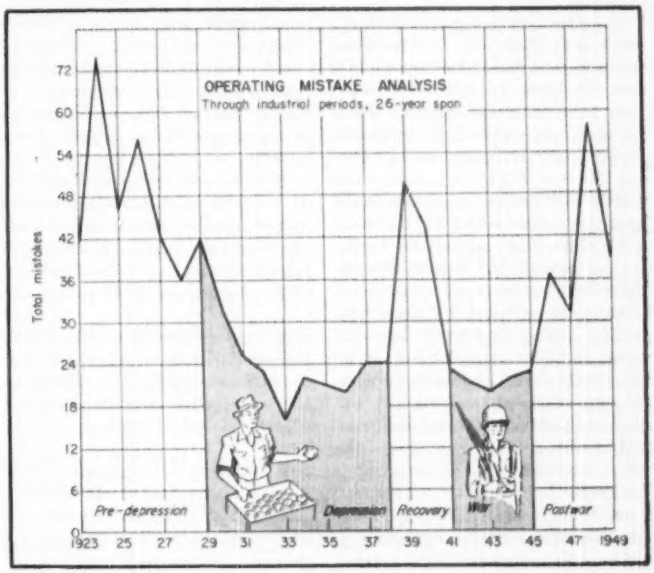


FIG 1—RELATION EXISTS between number of mistakes and economic prosperity, mistakes being at a minimum during periods when jobs are few or national crisis motivates an urgent sense of responsibility. PP&L's program helped decrease mistakes 35% in 1949 under '48

Based on a paper presented before the Systems Operation Committee of the Pennsylvania Electric Association.

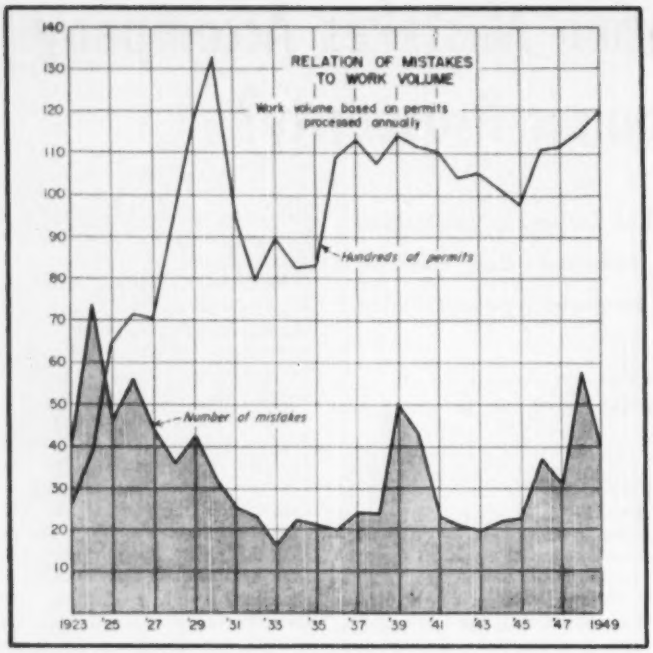


FIG 2—WORK VOLUME definitely affects mistake frequency, but it is not the controlling factor, nor always predominant. Natural causes and repetitive work contribute errors

mained flat for 6 years with the all-time low of 16 mistakes being established in 1933.

In expansion and post-depression, every type of activity is carried on. More work is demanded than there is time available, there is not sufficient time to consider carefully all details of good planning, there is greater fatigue—and the curve goes up. During the war years, construction was active and routine work continued apace. For this period, the curve did not follow what appears to be the logical pattern but remained comparatively flat for a 4-year period.

Summing up "worker attitude" prevailing during depression and war years, it can be reasonably concluded that workers will voluntarily do more to police their own efforts and will assume an attitude of serious and conscientious application if given the proper stimulus and a compelling incentive.

As industry emerged from the depression during the late '30's, Fig 1 reflects the occurrence of a relaxed attitude and release from pressure by a definite up-swing from an average of 23 mistakes over a 5-year period to 50 mistakes in 1939. However, unsettled work conditions, beginning of World War II and the subsequent involvement of our nation in the war brought a quick reversal of the upward trend. Individuals, profoundly influenced by that urgent sense of responsibility, produced one of the best four-year periods in the company's history.

With the conclusion of World War II, a repetition of the post-depression cycle took place with the curve bounding from the war years' average of 22 mistakes to a total of 58 mistakes in 1948—the highest in 24 years!

Types of Mistakes... The following tabulation classifies mistakes in the order in which the greatest number occur. This information is graphically plotted in Fig 3.

	Approx. Percent of Total Mistakes		
	1938-1947	1948	1949
1. Lack of attention to details	39.0	45.0	42.0
2. Incorrect switching—directed	20.0	22.0	24.0
3. Incorrect switching—undirected	13.0	9.0	18.0
4. Failure to follow instructions	7.0	14.0	11.0
5. Failure to give proper instructions	5.0	2.0	5.0
6. Incorrect placing of grounds	5.0	0.0	0.0
7. Failure to remove grounds	3.0	2.0	0.0
8. Failure to assume System Operating Authority	3.0	0.0	0.0
9. Mistake in construction	3.0	3.0	0.0
10. Over-run prearranged interruption time	3.0	3.0	0.0

In this tabulation we note that the mistakes cataloged through the 1938-1949 period fall within many categories but that the predominant classification shows 70% or better of the total mistake occurring as the result of "Lack of attention to details" and "Switching errors." Regardless of whether we are in depression, war, or expansion periods, the same classifications head the list and the same general relationship holds true.

Most of the errors in this 70% or better group stem from the basic causes of carelessness, indifference or inexperience. Here is where preventive efforts must be concentrated, where pressure must be applied, and where by the proper methods, the most pronounced and immediate results can be realized.

Suggested Program for Prevention... A complete program seemed to be divided into three aspects: (1) Education of employees so they may know more about system-wide operation, a thorough practical knowledge of equipment, and instructions and their application. (2) Analysis of mistake operation to determine cause, the traits influencing individual performance, and other factors responsible for mistake commission, with a definite plan applying the results to future operation. (3) Driving home the importance and the responsibilities of supervision in good leadership, in maintaining job interest and worker incentive, in conveying to the employee a full understanding of all job requirements, and in taking positive action towards observance of all regulations and approved operating practices.

Education... Education programs should be formulated along uniform lines and then carried out by first line supervision acting as operating instructors. A suggested program sufficient to meet all practical requirements should include:

1. Contacts with groups or individuals as frequently as possible; the minimum number of contacts and

hours of instruction per year should be consistent with the ends to be accomplished.

2. Educational schools with established courses and well-defined study plans. Where necessary the correspondence idea could be employed.

3. Planned programs of operating instruction review and discussion of other operating subjects as a rainy day activity.

4. The use of hypothetical problems is urgently recommended to the entire operating group. These problems give the supervisor an opportunity to discover tendencies toward mistake commission. The men preparing and presenting hypothetical problems automatically brush up on their operation.

5. Use of visual aid demonstrations to explain operation, capabilities and limitations of equipment.

6. Adoption to the extent feasible of the "discussion" method at educational gatherings, to encourage participation for the purpose of instilling in field men the feeling that they "belong"; and to secure their impressions and ideas on current practices, and suggestions on improved operating procedure.

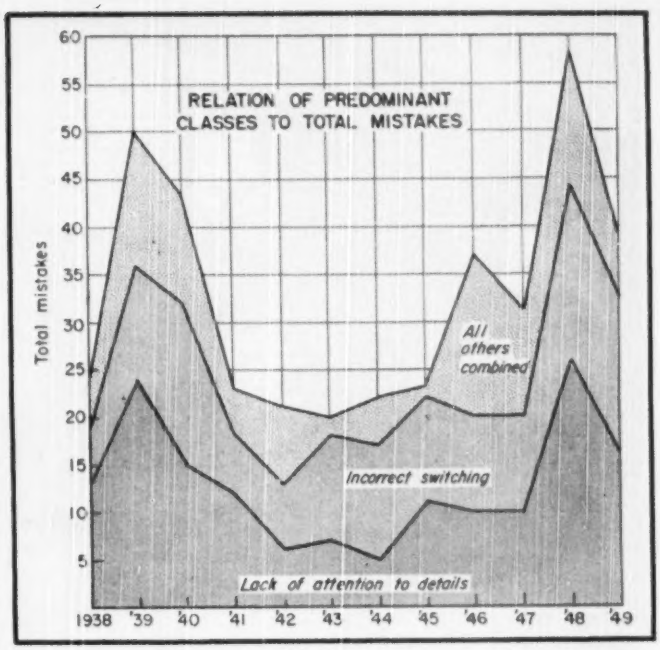


FIG 3—PREDOMINANT CLASSIFICATION places 70% or more of mistakes under "Lack of attention to details" or "Switching errors," no matter what economic situation is

Investigation and Analysis . . . Merely dubbing a man careless or indifferent is unfair to the individual and lends nothing to mistake prevention. Our problem is to find out why men become careless and indifferent —what psychological, personal or occupational factor is involved and how it can be quickly and best corrected.

The following outlines a proposal for investigating, analyzing and processing operating mistakes:

1. All mistakes should be thoroughly investigated by the meeting method within 48 hr, and an intimate knowledge secured of the individuals involved. Second-line supervision should determine the facts of the investigation and prepare a detailed report of the findings and recommendations.

2. The field investigation report should be processed by an impartial mistake committee composed of representatives of each branch of the operating department. It should give guidance to the program to the end of fairness to the individual, to make recommendations on the disposition of a case, and for improvement of equipment, practices, methods, instructions, tools, etc. Department heads should decide on and carry out any disciplinary action required.

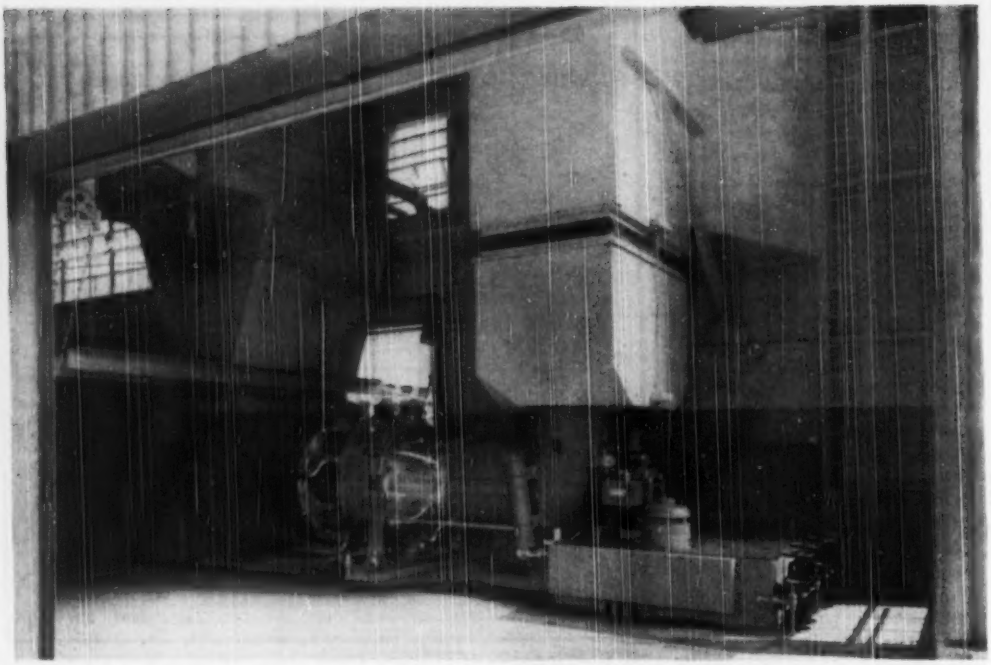
3. From the investigation reports, the mistake should be properly classified by the committee and cataloged according to the underlying personal trait, or whether lack of quality or experience, insufficient training, or delinquent supervision was responsible.

Records should be kept on each individual committing a mistake so that it can be pointed out to supervision when it is necessary to make closer observation of an employee to determine his ability to fulfill all requirements of his job, or when an employee is being pushed beyond his mental or physical capacity.

Supervision . . . If supervision is not fully effective in enforcing rules and regulations, then the seeds of carelessness and indifference have been sown.

Therefore, in any plan of mistake prevention it is plain that supervision must perfect leadership technique, eliminate its own shortcomings and those of individuals and organizations, and exert relentless pressure to keep field men cognizant of their individual responsibilities. Instructions must be kept up-to-date, and proper tools must be provided. The supervision must be constantly alert for better tools and better methods. And, of course, constant follow-up by supervision is necessary.

Conclusion . . . Every employee possesses an inherent desire to do a good job; he wants to be identified as an essential part of the organization, and wants to be reassured that his activity is a contributing factor in operating accomplishments. He will react to applied psychology and fall into a desired pattern of "worker attitude" and "job application" if we appeal to his pride, stimulate his desire to function creditably, provide him with a high level of leadership, and give recognition to his efforts. How well we succeed will depend on how much incentive we create, how much training we supply, how much supervisory interest is displayed and to what extent the employee's efforts are recognized.



GAS-TURBINE-GENERATOR set of 3,500-kw rating operating in Oklahoma Gas & Electric Company's Arthur S. Huey Station

Economic Place of Today's Gas Turbines

Gas turbines appear appropriate where fuel is cheap, water expensive, peak loads are to be served or stub-end generation reinforced. No units now available are competitive with large steam turbines

A. G. MELLOR, Central Station Engineering Div
General Electric Company, Schenectady, N. Y.

GAS TURBINE generators are available only in small sizes (5,000 kw and below) but it is anticipated that, as more operating experience is gained and further improvements in design are made, very much larger units will be made available. This paper attempts to outline the economical fields of application of prevailing gas turbine units with some comments on the principal factors affecting their use and on future developments that may greatly extend their application. For the purpose of making economic comparisons between gas turbines and other forms of prime movers for power generation, the two types of gas turbines manufactured by the author's company are taken as being typical of gas turbine generator units that will be available during the next few years.

The first of these units is a 3,500-kw simple, open-cycle type consisting of a single axial flow compressor directly connected to a two-stage turbine which also drives a generator through a reduction gear. No regenerators, intercoolers or reheat are used. This unit has an over-all thermal efficiency to the generator terminals of approximately 16% based on the lower heating value of the fuel. Due to the fact that the compressor operates at constant speed regardless of the load on the generator, the part load efficiency of this unit is relatively poor. Water consumption is low, being about 320 gpm for the lubricating oil and generator air coolers. It is estimated that a complete power plant using this gas turbine would cost approximately $575,000 or $164.50 per kw.

Simple Cycle Installations . . . Such a 3,500-kw unit is in operation on the Oklahoma Gas & Electric Co system using natural gas as fuel. In this installation the exhaust heat from the gas turbine is used for heating feedwater in a steam station, resulting

Present Day Gas Turbines Have a Logical Place in the Power Industry

1. In their present state of development, gas turbines cannot be considered competitive with very large modern high pressure and temperature steam stations either in first cost or in efficiency, but in many cases are competitive with other types of generating units of comparable size.

2. (a) Gas turbines available at present can often show savings over steam stations of equivalent size when the same fuel (natural gas or Bunker "C" oil) is used in both stations.

(b) In areas where the cost of obtaining water is high, the gas turbine has an additional advantage over the steam station due to its very much lower water requirements.

(c) Because of low cost and simplicity of gas turbine foundations and housing, total installed cost and recovery value may show a distinct advantage.

3. The gas turbine cannot, in general, compete on an operating cost basis with a small steam station in areas where coal is used in the steam station and Bunker "C" oil per Btu is used in the gas turbine unless the cost of Bunker "C" oil is not more than approximately 10% greater than the cost of coal, per Btu.

4. When both units use the same fuel, the gas turbine can compete with the diesel station in cases where the cost of fuel is low, such as in natural gas areas.

5. When the cost of Bunker "C" oil is 80% or less of the cost of diesel oil, the gas turbine can compete with the diesel at all fuel cost levels.

6. The most favorable conditions for economical application of gas turbines appear to be:—

(a) Areas where either natural gas or Bunker "C" oil is the cheapest type of fuel and particularly where water costs are high.

(b) Where peaking capacity is required which will only be operated a small percentage of the time.

(c) Some cases where the gas turbine can be used as an end-of-line plant as an alternate to building new transmission facilities.

(d) Special applications where conditions offer advantages for exhaust waste heat recovery.

7. Development of coal combustion and of the automatic unattended gas turbine generating station will greatly extend their field of application.

in an increase in output of the steam turbines and an over-all improvement in station heat rate.

Another 3,500-kw unit is now being installed as a peaking unit on a hydro system in New England where it replaces a small 30-year-old low pressure, low temperature steam turbine.

Regenerative Installation . . . The second type of gas turbine is a 5,000-kw, open-cycle, two-shaft unit consisting of a variable speed low pressure compressor and a single stage low pressure turbine on one shaft and a high pressure compressor and two-stage turbine on another shaft which also drives the generator through a reduction gear. No reheat is used but intercoolers are used between the low and high pressure compressors and exhaust heat is recovered by heating the air leaving the high pressure compressors, in regenerators. This unit has an over-all expected thermal efficiency to the generator terminals of approximately 28% based on the lower heating value of the fuel. The fact that the speed of the low pressure turbine and compressor varies with load results in a good part load efficiency. Water consumption is about 800 gpm through the intercoolers and about 320 gpm for lubricating oil and generator air coolers and for turbine cooling. It is estimated that a complete plant using this unit would cost about $1,200,000, or $240 per kw.

A 5,000-kw unit will soon be installed on a New England hydro system where it will operate as a base load unit during periods of low water at the hydro plants and as a peaking unit during periods of high water. An additional unit is also on order for a New England system for baseload operation.

Two 5,000-kw units will also be installed in Oklahoma to supply local loads at the end of long transmission lines.

Either Oil or Gas . . . Both of the above gas turbines can be built to operate on Bunker "C" and diesel oil or on natural gas. In general, the first cost of a gas turbine generating station will be about the same whether oil or gas is used as fuel. Gas burning plants will usually require a gas compressor to raise the fuel pressure to that required by the gas turbine. Oil burning plants require fuel storage facilities, fuel handling pumps and fuel heating and cleaning equipment.

Factors in Comparisons . . . Due to the relatively small size of the units at present available, the gas turbine cannot be considered as a direct competitor of the very large modern steam generating station. Therefore, in making economic comparisons between various forms of generation, steam turbines and diesel stations of comparable size to the gas turbines were considered. The assumptions made in regard to heat rates and other factors are given in the Appendix.

Components of operating cost considered in the comparisons made were fuel cost, fixed charges on investment and, in some cases, the cost of water. In all cases fixed charges were taken as 12% per year. Operating and maintenance costs were assumed to be equal for all forms of generation and so were neglected in the comparisons. Operating experience with gas turbines is at present very limited but it can be expected that operating labor costs for a gas turbine plant will be lower than for a comparable size steam station. It is also expected that the maintenance charges on steam

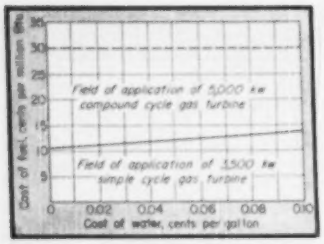

Cost of fuel, cents per million Btu
Field of application of 5,000 kw compound cycle gas turbine
Field of application of 3,500 kw simple cycle gas turbine
Cost of water, cents per gallon

FIG 1—COMPARISON of simple and compound cycle gas turbines for base loads

station equipment plus the relatively long outage time for boiler maintenance will be as great as the maintenance charges for the gas turbine on which most repairs are made quickly.

Comparison of Two Types . . . The fields of application of the 3,500-kw simple cycle gas turbine and the 5,000-kw compound cycle unit are shown in Fig 1, on the basis of fuel and water cost. The dividing line shown between the two units applies approximately for all load conditions from 100% down to 50% load if the units are operated 100% of the time. This comparison indicates that the low efficiency gas turbine can only be justified as a continuously operating unit in areas where fuel is very cheap such as certain localities where natural gas is available.

However, when applied as peaking units, operating at high loads for short periods and shut down during off-peak hours, the dividing line between the two units is at a very much higher value of fuel cost. For example, if the units are operated at 100% load for only 20% of the time, the simple cycle unit will be more economical up to a fuel cost of about 52¢ per million Btu. As a peaking plant the simple cycle gas turbine has the advantage over a comparable size steam station in first cost and in elimination of boiler standby losses. It cannot be economically operated as spinning reserve due to the high no load fuel consumption.

The above comparison does not take into account the possibility of utilizing the waste heat in the gas turbine exhaust. This will be discussed later.

Gas Turbine vs Steam Stations . . . Since the cost per kw of steam generating stations varies widely for various installations, this factor has been treated as a variable in making comparisons between gas turbine and steam generating stations. It is estimated, however, that most steam stations of about 5,000 kw capacity will cost between $250 and $300 per kw of maximum capacity.

Figure 2A shows the saving in dollars per kw per year obtained by using gas turbines, at load factors of 50% and 100% for various steam station costs and assuming that cooling water costs nothing. Figure 2B shows similar savings at 100% load factor when cooling water costs 0.1¢ per gallon.

These figures indicate that the gas turbine has an advantage in cases where a steam station costs over about $225 per kw and has a great advantage in areas where water is costly to provide. In making these comparisons, it was assumed that the same fuel, either natural gas or Bun-

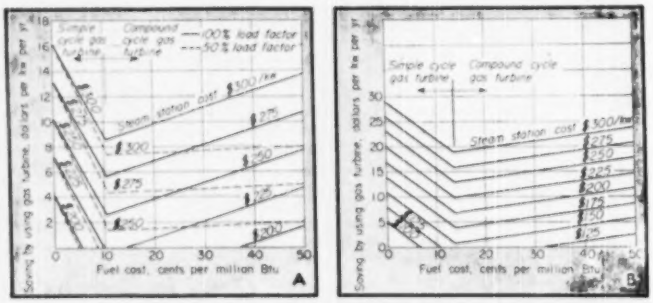


FIG 2—SAVINGS IN DOLLARS per kw per year of gas turbine station over steam station using the same fuel, (A) neglecting cost of cooling water, load factors of 50 and 100%, and (B) including cooling water at 0.1 cents per gallon, at 100% load factor

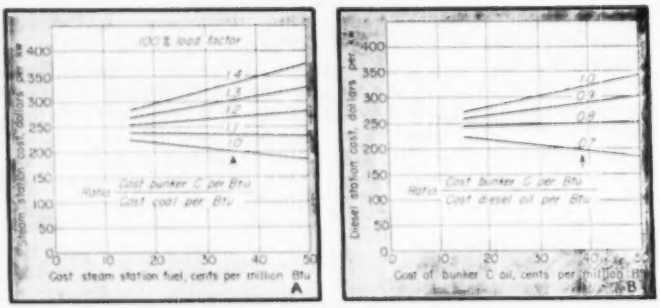

100% load factor
Ratio
Cost bunker C per Btu
Cost coal per Btu
Cost diesel oil per Btu
Cost steam station fuel, cents per million Btu
Cost of bunker C oil, cents per million Btu
A
B

FIG 3—IF STEAM STATION investment (A) is higher than chart shows (for specified relative fuel costs) a kwhr can be had cheaper with a gas turbine. Similarly (B) for a diesel

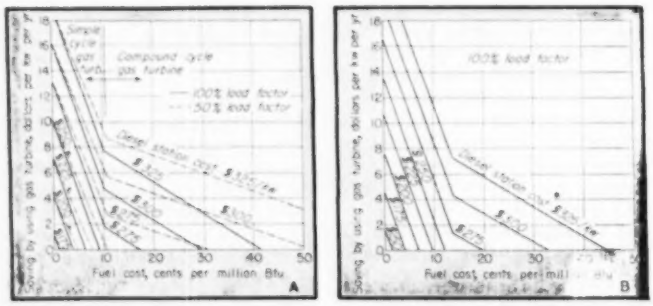


FIG 4—SAVINGS in dollars per kw per year of gas turbine station using the same fuel as diesel, (A) negelcting cost of cooling water, (B) including it at 0.1¢ per gal

ker "C" oil, was used in both the gas turbine and steam plants.

Figure 3A shows the cost of a steam station to give the same generating cost per kwhr as a gas turbine when coal is used in the steam plant and Bunker "C" in the gas turbine. If the steam station cost is above that shown, it will be more economical to use a gas turbine. This figure indicates that when the cost of coal is appreciably less than that of Bunker "C" oil, the gas turbine can rarely be justified and also emphasizes the desirability of developing a coal burning gas turbine. If the cost of water had been taken into consideration in this comparison it would have resulted in a more favorable position for the gas turbine but there are few locations in which water is expensive when coal is cheap.

Gas Turbine vs Diesel . . . Figure 4A shows the saving made possible, at load factors of 50% and 100%, by using a gas turbine instead of a diesel engine when both units use the same fuel and the cost of cooling water is neglected. Figure 4B shows similar savings, at 100% load factor, when cooling water costs 0.10 cents per gallon. Assuming that a complete gas-diesel generating station would cost about $275 per kw, these figures indicate that the use of a gas turbine will result in a saving if the cost of fuel is below about 20¢ per million Btu, which is true in most areas where natural gas is readily available.

Gas Turbines in Operation

Utility	No.	Kw Each	Cycle	Fuel	Service
Oklahoma Gas & Electric	1	3,500	Simple	Gas	Base Load & Heat Recovery
Central Maine Power Co	1	3,500	Simple	Oil	Peak Load

Gas Turbines on Order

1	5,000	Regenerative	Oil	Back-up for Hydro
1	5,000	Regenerative	Oil	Base Load
2	5,000	Regenerative	Gas	End-of-line

These figures can also be used to compare gas turbines and diesel engines when both plants use Bunker "C" oil. In these cases the gas turbine can only be justified if the cost of the diesel station is above about $300 per kw.

Figure 3B shows the cost of a diesel station to give the same generating cost per kwhr as a gas turbine when the diesel station uses diesel oil and the gas turbine station uses Bunker "C" oil. The ratio of the cost of Bunker "C" oil to that of diesel oil is often of the order of 0.70 or lower which puts the gas turbine in a very favorable position relative to the diesel station.

End of Line Plants . . . It has been proposed that a good application of the gas turbine would be on outlying parts of a power system as an end-of-line plant. As has been previously shown, the gas turbine can successfully compete with a small steam station where the same fuel is used in both stations but in general cannot compete with a steam station using cheap coal. Figure 5 indicates the relative advantages of generating power at a coal fired steam station and transmitting it to the load against generating power at a gas turbine plant located at the load. From this figure it is apparent that when there is a considerable difference in the cost of fuel at the gas turbine and at the steam station, a large transmission line investment can be made before it is more economical to use a gas turbine at the load.

This comparison does not take into account the probable improvement to local service due to increased reliability and improved voltage conditions resulting from having generating capacity adjacent to the load. These factors may be very important under some circumstances, particularly where the transmission system is subject to repeated or prolonged outage.

Exhaust Heat Recovery . . . Simple cycle gas turbines, such as the 3,500-kw unit referred to above, in which no heat is recovered from the turbine exhaust, operate with fairly high exhaust gas temperature. For the particular unit referred to in this paper, about 59,000,000 Btu per hour, above an ambient temperature of 80 F, is discharged in the turbine exhaust gases at full load. Of this exhaust heat, it is practical to recover about 40,000,000 Btu per hour for use in generating low pressure steam, for feedwater heating in a steam station or for process heat in an industry. The disadvantage of such a system of heat recovery is the wide variation in the amount of heat recoverable with variable load on the gas turbine. This disadvantage can be overcome to some extent by auxiliary firing or by throttling the gas turbine exhaust when the gas turbine is operating at reduced load.

The possibility of recovering heat from the gas turbine exhaust greatly improves the over-all heat rate of the unit and makes feasible some applications which could not otherwise be justified economically.

The compound cycle gas turbine, using regenerators, does not afford

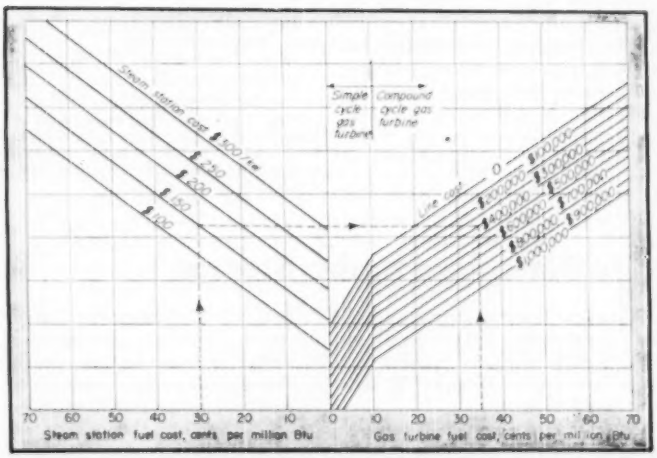


FIG 5—GAS TURBINES as end of line plants will probably have to vie with investment in transmission capacity that is carrying power generated at a coal fired steam station

the same opportunity for external waste heat recovery, as a large portion of the heat available in the turbine exhaust is recovered in the gas turbine cycle. The final exhaust temperature leaving the regenerators is low enough that it is very questionable whether external heat recovery equipment could be economically justified. The heat available from the intercoolers of this unit is at low temperature and so could not be used for steam generation. It might, however, be used as the first stage of feedwater heating in a steam plant or for industrial uses where a supply of hot water is required.

Portable Units . . . The comparatively small size and weight of the 3,500-kw simple cycle gas turbine suggests the possibility of building portable generating units for emergency service in areas affected by storms, etc. If necessary, lube oil cooling and generator cooling could be done by air, thus eliminating the need of a cooling water supply. Such a plant could be put in operation in a matter of hours after reaching the affected area.

Operation at High Ambient Air Temperatures . . . The gas turbines referred to are rated at 80 F ambient air temperature and 1,500-ft altitude. At ambient air temperatures above 80 F, the maximum output of the simple cycle 3,500-kw unit must be reduced to keep within the allowable turbine inlet temperature. The compound cycle 5,000-kw unit is equipped with variable inlet guide vanes on both the low and high pressure compressors allowing full load to be carried up to an ambient air temperature of 110 F. The maximum load on the unit must be reduced with increase in air temperature above this point.

In order to enable the units to carry full load at high ambient air temperatures it is economically practical to cool the air entering the compressor, if sufficient water is available at reasonable cost, by use of water cooled air coolers or by evaporative cooling.

Future Developments . . . Development of a successful coal burning gas turbine would greatly increase their possible field of application by making the units competitive with similar sizes of coal burning steam plants. Although considerable effort is at present being put on this development, it is probable that it will be several years before a coal burning gas turbine will be commercially available. It can be expected that such a unit when developed with its required auxiliary devices, will have a somewhat higher cost than oil or gas burning units but will have very approximately the same efficiency.

As more experience is gained in the operation of gas turbine units and their reliability is proved, it is very probable that there will be a demand for automatic unattended stations. Controls that are practically automatic are already developed for starting and supervising the operation of gas turbine generators and so the development of an automatic, unattended station should present no great difficulty, particularly for gas burning units which do not have the complication of fuel heating and cleaning equipment required in oil burning plants.

The development of unattended stations, with a consequent reduction in operating cost, should extend the application of gas turbine generator units, particularly as peaking plants on the outlying or isolated parts of power systems.

APPENDIX

Assumptions

1. 3,500 Kw Simple Cycle Gas Turbine

(a) Total installed cost per kw	164.50
(b) Fixed charges per year per kw at 12%	19.75
(c) Heat rate at 100% load	23,000 Btu/kwhr
(d) Heat rate at 50% load	34,200 Btu/kwhr

2. 5,000 Kw Compound Cycle Gas Turbine

(a) Total installed cost per kw	240.00
(b) Fixed charges per year per kw @ 12%	28.80
(c) Heat rate at 100% load	13,000 Btu/kwhr
(d) Heat rate at 50% load	15,100 Btu/kwhr
(e) Heat removed in intercooling at full load	2,770 Btu/kwhr
(f) Cooling water make-up required	0.33 gal/kwhr

3. Steam Plants

(a) Annual rate of fixed charges	12%
(b) Heat rate at 100% load	14,500 Btu/kwhr
(c) Heat rate at 50% load	15,500 Btu/kwhr
(d) Cooling water make-up required	1.44 gal/kwhr

4. Diesel Plants

(a) Annual rate of fixed charges	12%
(b) Heat rate at 100% load	10,200 Btu/kwhr
(c) Heat rate at 50% load	11,950 Btu/kwhr
(d) Cooling water make-up required	0.40 gal/kwhr

5. For End of Line Plants

(a) Load at end of line	5,000 kw
(b) Load factor	50%
(c) Capacity loss in line =15% of peak load	
(d) Loss factor of line	0.30
(e) Annual rate of fixed charges on line	12%

Note: Heat rates shown are based on approximate higher heating value of fuels. In an analysis of this type, the variation in heat rates with different types of fuels is relatively unimportant.

• • •

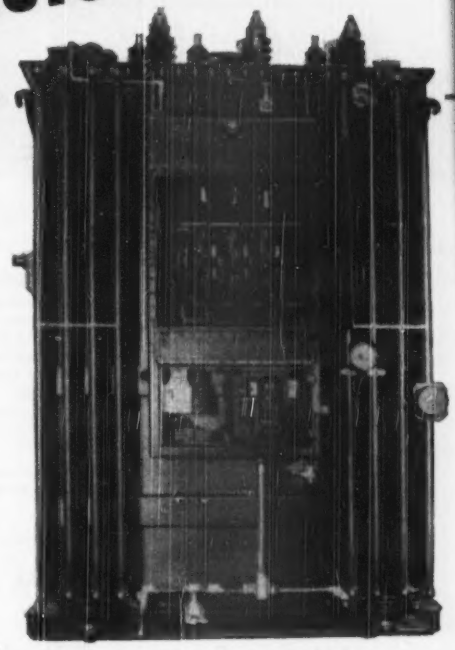
Wind Power to Pump Into Hydro Storage

ITALIAN ENGINEERS propose to circumvent the irregularity of wind power by using it, whenever available, to pump water into hydroelectric power station reservoirs. This would avoid synchronization necessary to feed the output directly into the transmission system.

Special "metadynamos" have been designed by Galileo Ferrari Institute for the purpose. Each consists of two normal dynamos coupled to variable-output aeromotors. The system would be dc.

A representative unit of 500 kw has been designed for lifting sea water required by a power station supplying a pyrite mine and the associated villages on the island of Giglio. Damming of a valley will store some 30 million cu ft—more than enough to offset periods of light winds. It is expected that the installation will produce 2,300,000 kwhr per year at an outlay of 152 lire per kw. The government is expected to approve the project, outlined in a report to ECA.

Now—
Get load ratio control —still save with RM* Transformers



Automatic load-ratio-control equipment, for changing taps under load, is now optional on General Electric three-phase oil-immersed RM-listed Power Transformers:

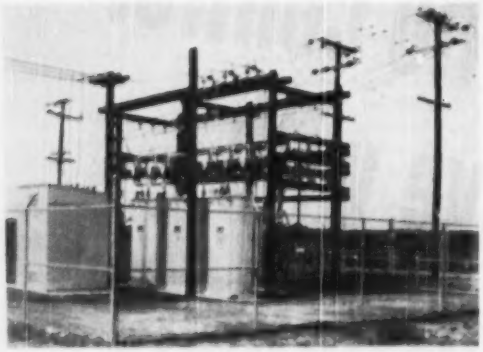
20% range—10% plus to 10% minus
32 5/8-per-cent steps
Available in 1391 different ratings—
All kva's from 750 to 10,000, three-phase
All EEI-NEMA preferred voltage ratings between:
6900 and 67,000 high-voltage
2400 and 14,400 low-voltage

*RM means "Repetitive Manufacture"—a type designation covering G-E power transformers with standardized construction up to 10,000 kva and 69 kv. This effective standardization—sensibly flexible with optional features—spells lower costs for you. RM prices are eight per cent lower. RM shipments with load-ratio-control average 15 weeks.

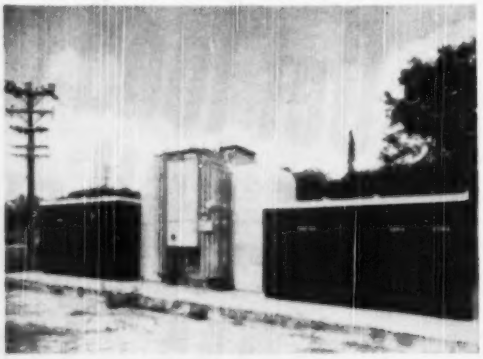
For information on RM transformers with load-ratio-control feature, ask your nearest G-E Apparatus Sales Office. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN



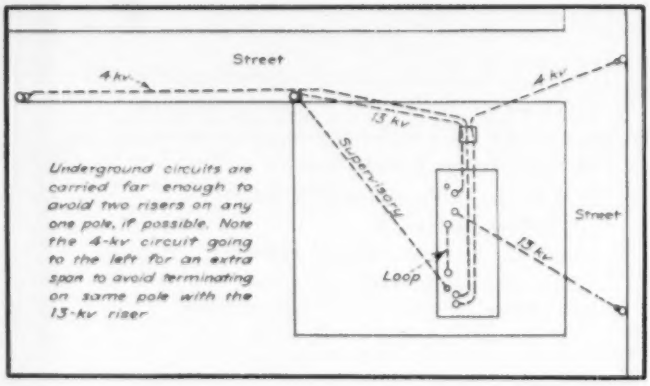
CONGESTED DESIGN used formerly, with all circuits coming in overhead, lacked attractive appearance desirable in residential areas



SAFE, NEAT DESIGN is accomplished by using underground circuits. Result is improved appearance and safer working conditions

Underground Feeders Make Substations Safe and Neat

R. E. BROWN
Substation Engineer
City Public Service Board
San Antonio, Tex.


Street
4 kv
4 kv
13 kv
Supervisory
Loop
Street
13 kv
Underground circuits are carried far enough to avoid two risers on any one pole, if possible. Note the 4-kv circuit going to the left for an extra span to avoid terminating on same pole with the 13-kv riser

To ELIMINATE congestion around unit substations in residential areas on the San Antonio system, practically all supply and feeder circuits have been placed underground. In addition, this practice makes for safer climbing conditions on poles.

Pole riser arrangement varies with conditions at each location. In some cases it is necessary to go underground for a considerable distance from the station to secure a neat appearance and to avoid congestion.

In bringing circuits out of substations underground, usually each circuit goes to its own riser pole and in its own direction. In this way there is only one riser on a pole and the inevitable multitude of circuits centering on the substation is out of sight. In photograph above, right, two risers are on the pole at left.

Wider Spaced Gills Save on Economizer Cleaning

To REDUCE fouling rate and permit better cleaning by air lance, or poker rod if necessary, wider spaced annular fins have been installed for trial in lower sections of economizer tubes. By spacing the fins farther apart and discontinuing the former practice of frequent water washing, a saving of $3,000 per year for each economizer is anticipated by Consolidated Edison Co of New York.

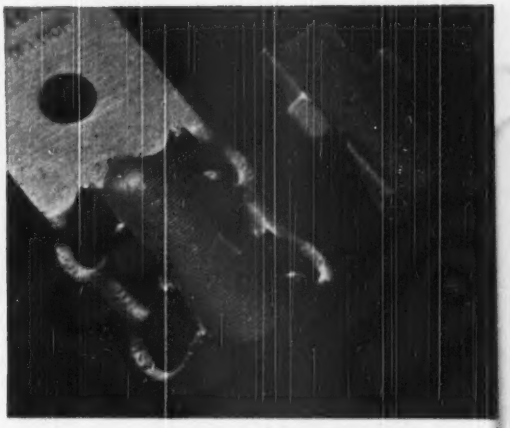
The program was adopted after experience had shown that (1) Fouling progresses despite frequent water washing and cleaning and (2) retubing of lower half becomes necessary after five or six years because of reduced capacity and efficiency.

GENERAL ELECTRIC POWER CONNECTORS HAVE

MACHINE-SERRATED CONTACT SURFACES

for high pull-out strength

for low contact losses



Here's the way the machine-serrated contact surfaces on G-E power connectors bite into the conductor (500 MCM tubing shown). For this test a hand wrench was used to tighten the connector (right). Tension was then applied. Above photo shows that the copper "backed up." This action assures a high-conductivity joint that will resist vibration and give positive pressure on the conductor at all times.

Disassembled G-E power connector showing the sharp serrations machined (not merely cast) into the contact surfaces—an exclusive General Electric feature. Note that all contact surfaces are silvered, another standard feature on all G-E connectors. The photo also shows the interlocking sides that confine cable strands within the conductor enclosure thus obtaining full advantage of the cable's current-carrying capacity.

Place an order today with your G-E sales representative and start realizing the many benefits to be gained by using General Electric connectors. Also, write for a copy of bulletin GEC-400 that contains 40 pages of valuable information on G-E connectors and see for yourself how easy they are to order. Write to *Apparatus Department, Section 856-54, General Electric Company, Schenectady 5, New York.*

GENERAL ELECTRIC

856-54

With reduced fouling rate, it is expected that after a few years lower tubes can be removed, allowed to "weather" outside and then be cleaned and then be used in some other economizer. Wider spacing of gills in lower bank reduces total economizer surfaces about 10%, but it is expected that this difference will be offset by the generally cleaner condition of the economizer. Efficiency is expected to remain the same.

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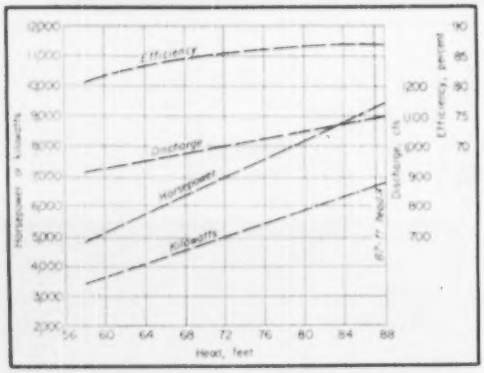
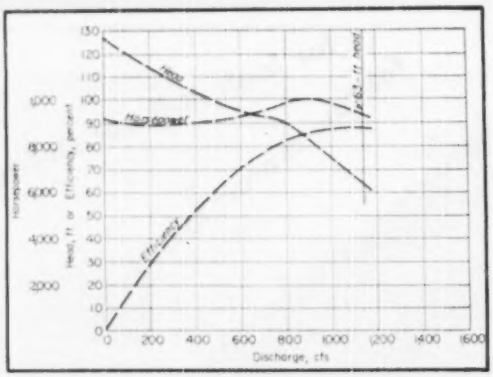


AS A GENERATOR . . . Expected performance characteristics for pump-turbine operating as generator. At 87-ft head and 163.6 rpm, maximum efficiency is 87%; output, 6,750 kw; and discharge, 1,100 cfs



AS A PUMP . . . Pump-turbine operating as pump is expected to have these performance characteristics. Maximum efficiency will be 88%. With 63-ft head and at 163.6 rpm, it will pump 1,150 cfs

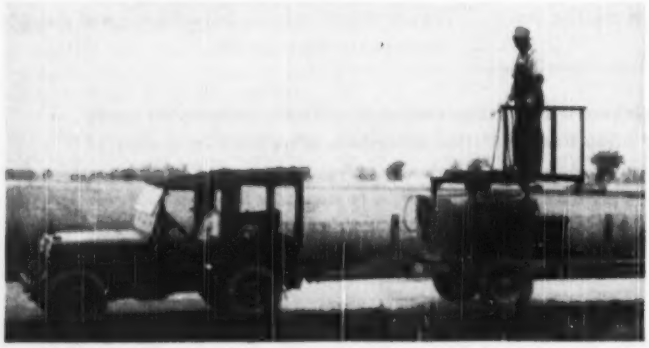
Pump-Turbine Unit for Pumped-Storage Hydro

A PUMP TURBINE, motor-generator unit for use in pumped-storage hydro installations has been developed by Allis-Chalmers Mfg Co. This single unit, which runs either as a pump and motor or as a turbine and generator, has these expected maximum efficiencies: turbine-generator, 87%; pump-motor, 83%. Maximum power required for pumping exceeds maximum generated power by about 10%.

This unit, which incorporates modifications of the pump and minor modifications in the synchronous motor, is being tested in Milwaukee.

The pump-turbine unit can be designed for heads from 50 to 1,000 ft and for generating capacity up to 50,000 kva. It is designed to provide peaking power. As a generator it is anticipated that the unit will be operated at maximum capacity. Electrical equipment required includes that necessary for both motor and generator operation. However, since the unit will not operate as frequency or voltage regulator, consideration may be given to omission of the voltage regulator and pilot exciter.

R/W Along Highways Cleared With Chemicals



JEEP AND TRAILER moving along the highway are used to spray adjacent right-of-way. There is space for a spray operator on the trailer. Though 540 miles of line were sprayed, there was no damage to crops sufficiently severe to cause a complaint to be lodged

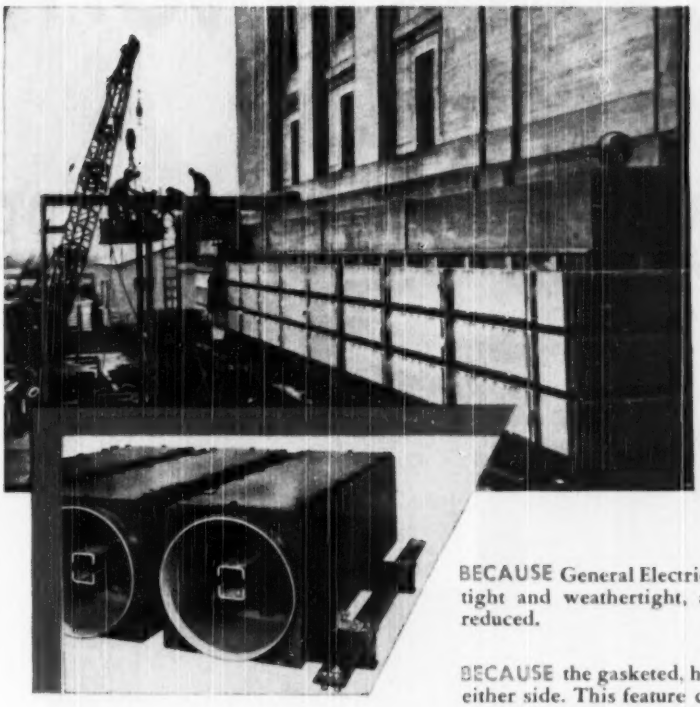
FRANK E. WARNER
Project Manager
Huntington County RMEC
Huntington, Indiana

LINE CLEARANCE by chemical spray has greatly reduced costs of maintaining line right-of-way on the Huntington County Rural Electric Membership Corp system. Spray equipment, installed on a trailer which accommodates a spray operator, is towed by a jeep. In many locations the operator can spray bushes and growth under lines that run along the highway as jeep and trailer move at a moderate speed. Spraying growth under lines along highways can be handled rather quickly in this man-

11 of the 16 largest turbine-generators*

use

GENERAL ELECTRIC ISOLATED PHASE BUS RUNS



RATINGS
15 and 23 kv
1200 to 7000 amperes

Your G-E Sales Representative has complete information about isolated-phase bus runs. Ask him for a copy of GEA-5460, a 28-page publication that will aid you in planning your bus runs, or write to *Apparatus Department, General Electric Company, Schenectady 5, New York.*

BECAUSE General Electric isolated-phase bus runs are dust-tight and weathertight, and maintenance costs are thus reduced.

BECAUSE the gasketed, hinged covers can be opened from either side. This feature cuts inspection time and costs by allowing access to the interior of the run from the most convenient position. Cover lugs release the cover without removal of bolts. The cover is swung open on either one of two sets of hinges.

BECAUSE you receive G-E isolated-phase bus runs completely assembled as a three-phase package, including running ground bus. They are installed in a short time at lower predictable costs.

BECAUSE you have one source of responsibility when you order from General Electric—complete co-ordination between planning, engineering, manufacturing, and service facilities to give maximum savings efficiency to the customer.

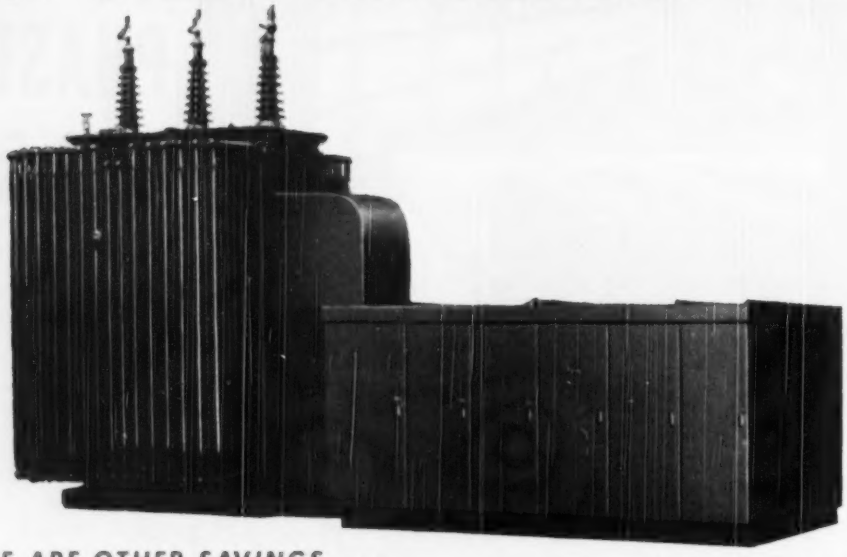
*Installed and planned, rated 6000 amperes and over.

GENERAL ELECTRIC

855-24

UNIT SUBSTATION

over FIELD-ASSEMBLED TYPE



Typical G-E Master Unit Substation

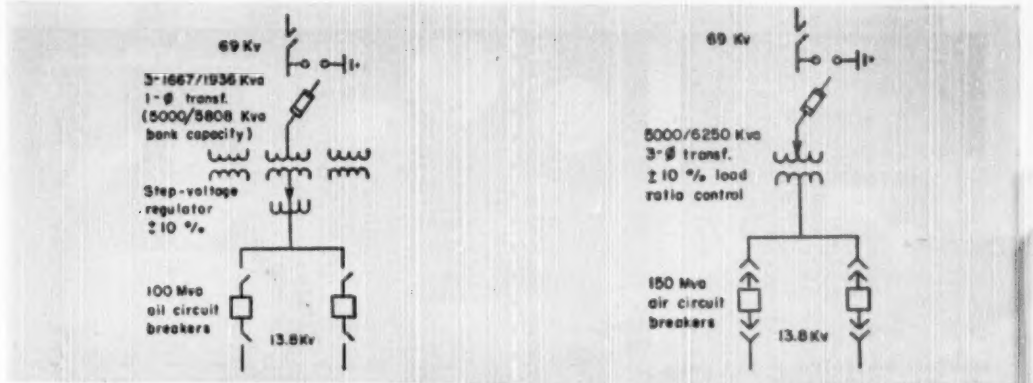
HERE ARE OTHER SAVINGS.....

When you order General Electric Unit Substations your engineering involves only a simple one-line diagram like the one at the right. We do all the detailed specs, prepare construction drawings, electrical diagrams, operating instructions and other paper work to give complete co-ordination of the project—all this on one purchase order, and at lower costs than field-assembled types.

For further information ask your G-E Sales Representative for the publications listed or write to *Apparatus Department, General Electric Company, Schenectady 5, New York.*

Master Unit Substations	GEA-3800
Single-circuit Unit Substations	GEA-4300
Package Substations	GEA-4500
Rural Package Substations	GEA-5276

SAVES 8.7%



FIELD-ASSEMBLED TYPE	
MATERIAL AND LABOR	$66,182
OVERHEAD (20%)	13,236
	$79,418

G-E UNIT SUBSTATION	
MATERIAL AND LABOR	$60,424
OVERHEAD (20%)	12,085
	$72,509

SAVINGS **by installing** G-E UNIT SUBSTATION **$6,909 or 8.7%**

In this typical cost analysis* that shows the obvious advantage of using General Electric Unit Substations purely from an investment standpoint, the labor estimates on both jobs were the minimum, a factor that favored the field-assembled type. As G-E Unit Substations arrive in large, completely-assembled units they are installed faster and easier, with lower labor costs.

Note that 20% overhead was added in both cases. For a comparison of *real costs*, 10% on the G-E Unit Substation against 20% on the field-assembled type would be more reasonable. Overhead is reduced when you order G-E Unit Substations because weeks spent in tedious engineering and detailing individual items are eliminated, at definite savings to you. Another item in favor of the G-E Unit Substation is its fan-cooled rating—442 kva greater than the field-assembled job. At a conservative $5 per regulated kva this gives you further savings in favor of the Unit Substation.

*For one installation in 1949.

MATERIAL AND LABOR	$66,182
OVERHEAD (20%)	13,236
EXTRA FAN-COOLED CAPACITY	2,210
	$81,628

LET'S EVALUATE

MATERIAL AND LABOR	$60,424
OVERHEAD (10%)	6,042
	$66,466

SAVINGS **by installing** G-E UNIT SUBSTATION **$15,162 or 18.6%**

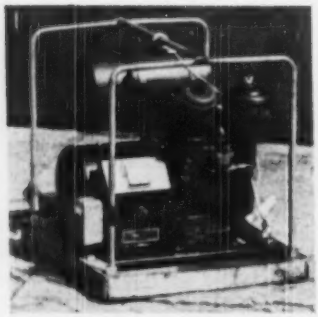
GENERAL ELECTRIC

ner. In some locations equipment must stop in order to do a thorough job.

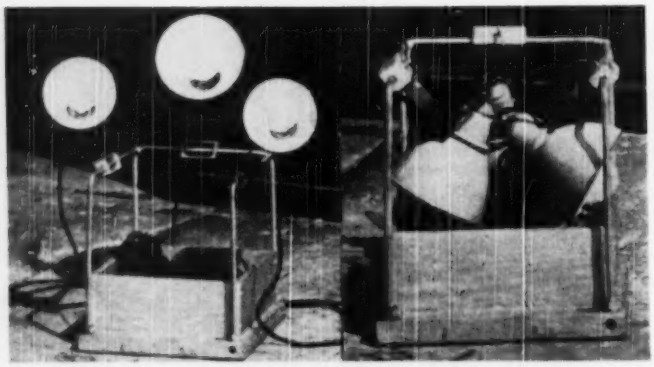
This year 541 miles of line were sprayed. Trees and brush along these lines had been cut by contract in the last three years. Total cost was: 978½ man hours; 332 gal of spray material which was a combination of 2-4-D (Dow Chemical) and 2-4-5-T (American Chemical); total miles driven 3,146; total cost $4,425.71.

It is estimated that this treatment will result in a 75% kill. On this basis the cost will be about $\frac{1}{5}$ that of cutting by contract. Using the equipment shown in the illustration there was very little damage to crops, and in no case was the damage severe enough for the property owner to make a complaint.

Frames Offer Protection for Emergency Lighting



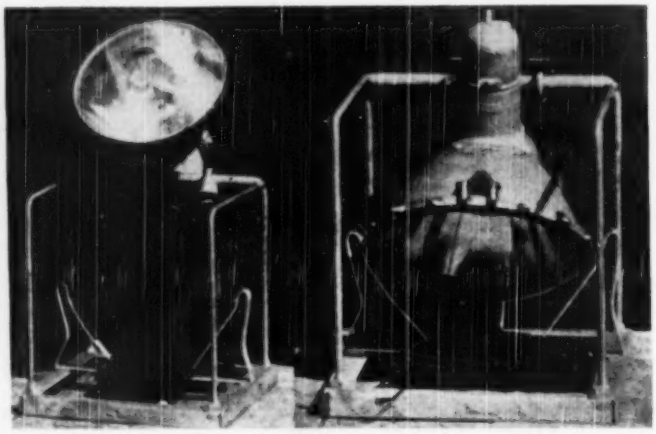
LIGHTING GENERATOR, a 750-w portable emergency unit, is bolted to two cross pieces of angle iron and the galvanized rods form a protective cage around the generator



PORTABLE STAND for three 200-w emergency lights. Each flood light is supported by a bracket (left). Lamps can be held securely in position shown or tilted downward inside the protective frame by loosening the set screws and rotating bracket to desired position

J. D. WINGFIELD
Substation Maintenance Foreman
Bluefield and Bluefield-Clinch Valley Districts
Appalachian Electric Power Co
Bluefield, W. Va.

To facilitate location and transportation of two 750-w, 115-v ac gasoline-driven generators and four flood lights during emergencies, three different types of frames are used. The frames protect the equipment during transit, aid placing it where desired, serve as mounts and permit the flood lamps to be swung into operating position quickly. As shown in the illustrations, the frames are made chiefly from ¼x2-in. angle iron, and ⅜-in. galvanized rod. Joints of some structural materials are welded. Rod sections are bolted to the angle iron bases.



CARRIER designed for a 1,000-w flood lamp is also a stand. It utilizes an adjustable bracket for supporting the flood lamp in the operating position (left) or tilting it down inside its protective frame during transit. Curved braces at the bottom of the stand are padded with felt to support the lamp and protect it from damage in transit

Lamp Bracket Construction

The 200-w lamp brackets are made of ⅜ x 1½ x 1½-in. angle iron welded to 4 in. channel iron 1¼ in. long and have a ⅜-in. set screw with a wing attached by welding. Bracket for the 1,000-w lamp consists of two ⅜ in. eye bolts on 4 in. center and mounting 3x3-in. angle iron 8 in. long for attaching the lamp fixture. Both types of brackets are drilled to fit on the rod frames. They are constructed so that the lights may be tilted down inside the protective frame during transit. In operation, lights tilt back on top of the frame into any desired position. This equipment, which has been used on several occasions, has proved worthwhile. The felt-padded, curved iron braces in the bottom of the flood lamp frame support and protect the lamp when it is tilted downward during transportation.

HI-TENSION NEWS *Junior*

After 25 years of service, this line was rebuilt to gain better operating characteristics. During these years, grounded steel crossarms resulted in severe lightning attack due to the low impulse value of the short insulator strings. Yet the original O-B insulators were reinstalled for a second, probably longer, period of service. This practice was based on careful inspection and testing that revealed no reason to reinsulate.

This experience brings out the strongest reason why you should specify O-B. We make no claim for anything radical in a *new* O-B suspension insulator. It is a product controlled by rigid industry standards. The unusual feature of this insulator consists of its ability to *retain* the values it originally possessed. If you want your suspension insulators as good 25 years from now as they are today—and here is proof this can be done—build your lines with O-B.

Ohio Brass

MANSFIELD, OHIO, U.S.A.

HI-TENSION NEWS *Junior*

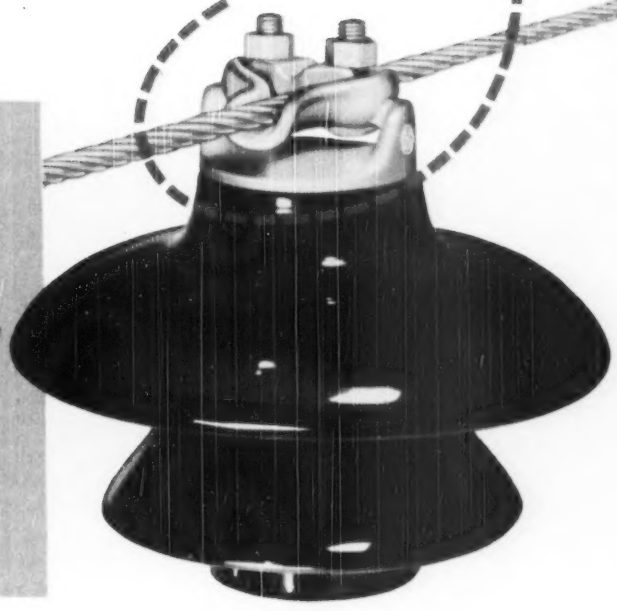
A Continuous Power Cable From Terminal To Terminal

Jumper splices at strain points in a transmission line are potential trouble-makers after a few years of load conditions. This trouble can be stopped by the practice of stringing through such points with an uncut conductor. By doing this you gain the effect of a continuous conductor from terminal to terminal, since line splices under high mechanical tension are much less subject to deterioration.

Continuous-cable jumpers are easy to install when using O-B strain clamps. The bolted connection makes up easily in the field without special equipment or specialized training of line crews, and will develop at least 90 per cent of the cable's ultimate strength without slip. Clamps may be loosened and relocated on the cable if adjustment in sag is necessary. The bolted clamp is also subject to effective inspection during installation as well as at any later time desired.

O-B strain clamps give you a combination of advantages not found in any other dead-ending practice. Specify them on your next transmission line.

Better Than A Tie Wire . . . *and Cheaper* From Every Standpoint



A skilled man can lash together a surprisingly good joint—if he *has* to—but a simple bolt will do it better, quicker, and more permanently.

We have "lashed" conductors to pintype insulators with a tie wire for many years, and also gotten a good job, but that doesn't mean it can't be done better.

O-B Clamptops eliminate this tie connection. A simple bolted jaw does away with the cost of the tie and most of the installation time. Because the clamp provides a permanently tight connection with the conductor, and the metal base of the clamp terminates within the porcelain body, electrical spitting is relieved and the electrostatic field of the insulator is modified beneficially, thus producing one of the most radio-quiet pintype insulators ever made.

Bolts, in place of a loose tie wire, make hot line changes safer and surprisingly easy, with conductor attachment fully as strong as a "cold" installation.

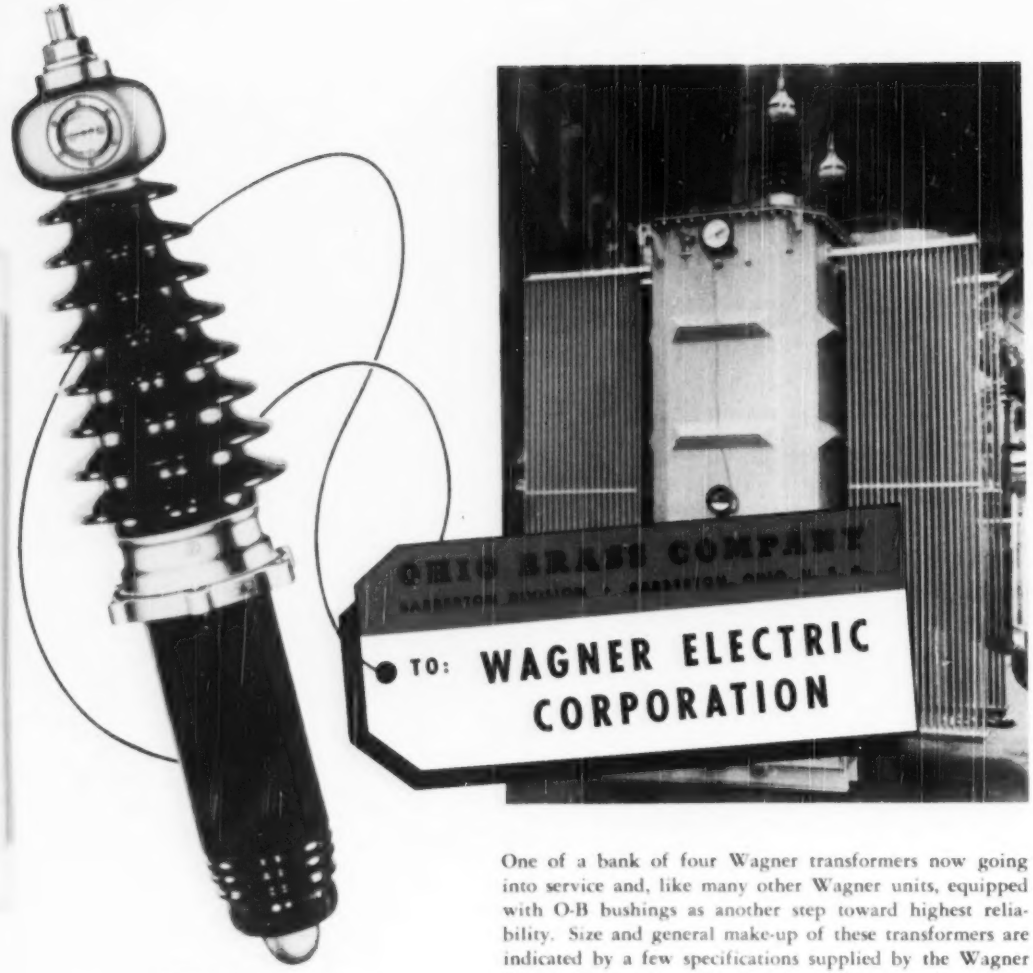
Slip strength of the Clamptop is from 2,000 to 2,500 pounds, depending upon the size of the insulator. This is materially higher than the best-made cold tie, and possibly double that of a hot tie.

Installed on the line, O-B Clamptop insulators are moneysavers; they are safer and better to handle hot; they keep down radio interference complaints—and they're thoroughbred O-B pintypes for satisfaction and durability.

Ohio Brass

MANSFIELD, OHIO, U.S.A.

HI-TENSION NEWS *Junior*



AND (B) BUSHINGS

ONE OF THE FINEST COMPONENTS OF ANY TRANSFORMER

One of a bank of four Wagner transformers now going into service and, like many other Wagner units, equipped with O-B bushings as another step toward highest reliability. Size and general make-up of these transformers are indicated by a few specifications supplied by the Wagner Electric Corporation: "Each unit rated at 5,000 kva, single phase, 60 cycle, 39,850/69,000 "Y" to 12,000 volts. Oil filled, self cooled, and equipped with vertical inert gas oil seal tank for oil preservation. Among other refinements are magnetic oil level indicators with low oil level alarm contacts, dial type oil temperature thermometers with alarm contacts, combination pressure and vacuum gauges . . . "

Ohio Brass

MANSFIELD, OHIO, U.S.A.

(B) 3044-H

Properties of Asbestos, Cotton, Duck, Rayon and Silk Insulation

Table lists properties of five types of insulation in the form of sheets and tapes, varnished and untreated

TABLE contains numerical values (in light type) wherever possible. Also a relative value (in bold-face type) of the property with respect to the other materials is assigned, based on a rating system. Rating of 1 indicates that the material designated is deemed most desirable for the property named. The ratings 1 to 10 are based on opinions reported by industrial users of these materials and should be considered in the light of ratings for other insulating materials reported in two subsequent installments.

Material	Dielectric Strength, vpm	Thickness, mils	Abrasion (resistance to)	Flexure (life under)	Creasing (resistance to)	Tear (resistance to)	Tensile (Breaking) Strength, lb in. width	Maximum Operating Temperature, deg C	Thermal Aging	Heat Conductivity	Resistance to				
											Moisture	Oil	Acid	Base	Solvent
ASBESTOS—SHEETS AND TAPES															
Cloth Unvarnished	50-100	26.0 to 46.0	**8**	**3**	**5**	**7**	wrp. 50 to 70 / fil. 12.5	130	**2**	**10**	**10**	**7**	**8**		**7**
Paper Standard Treated			**5**	**7**	**9**	**9**		130	**5**	**10**	**8**	**4**	**9**		**9**
Standard Untreated			**10**	**8**	**10**	**10**		130	**3**	**10**	**10**	**4**	**9**		**9**
COTTON FABRICS—SHEETS AND TAPES															
Yellow Varnished, Straight	800-1400	4.5 to 6.0	**6**	**4**	**4**	**6**	40	105	**6**	**8**	**7**	**4**	**9**	**9**	**4**
Yellow Varnished, Bias	950-1250	6.0 to 12.0	**6**	**4**	**4**	**4**	45	105	**6**	**8**	**7**	**4**	**9**	**9**	**4**
Black Varnished, Straight	1100-1400	9.0 to 13.0	**5**	**4**	**3**	**6**	57 to 60	105	**6**	**8**	**6**	**5**	**9**	**9**	**6**
Black Varnished, Bias	1200-1500	6.5 to 16.0	**5**	**4**	**3**	**4**	48 to 50	105	**6**	**8**	**6**	**5**	**9**	**9**	**6**
Unvarnished, Standard Straight	**9-10**		**5-6**	**7-8**				90			**9-10**				**1-2**
MISCELLANEOUS FABRICS—SHEETS AND TAPES															
Duck Sheet Black Varnished			**3**	**3**	**5**	**2**		105	**5**	**8**	**8**	**8**			**9**
Rayon or Sheet Tape Yellow Varnished		2.5 to 8.0	**3**	**4**	**4**	**8**	wrp. 25 / fil. 25	105	**5**	**8**	**3**	**3**			**6**
Silk Varnished Straight	1400 to 1900	2.0 to 8.0	**3**	**4**	**4**	**8**	wrp. 20	105	**5**	**8**	**3**	**2**			**6**
Silk Varnished Bias	1400 to 1900	2.0 to 8.0	**3**	**4**	**4**	**6**	wrp. 20	105	**5**	**8**	**3**	**2**			**6**

Adapted from "A Survey of Electrical Insulation Practices" by M. A. Faucett, C. Houpis and G. E. Leibinger; Circular Series No. 57, published by The Engineering Experiment Station, University of Illinois, Urbana, Ill.

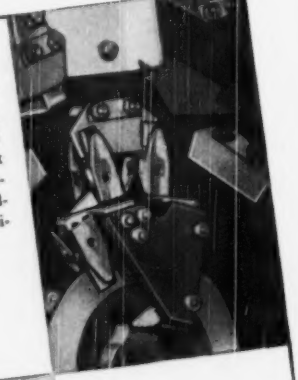
MOLONEY LOAD TAP CHANGERS

USED ON MOLONEY LOAD RATIO CONTROL TRANSFORMERS, REGULATING TRANSFORMERS, AND STEP VOLTAGE REGULATORS

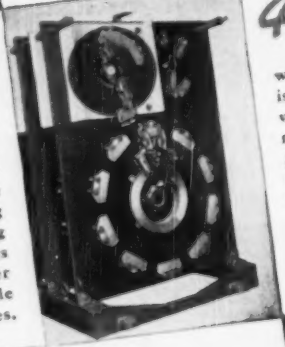
Better performance of Moloney voltage regulating apparatus is due in part to the advanced design of the Load Tap Changer switch assembly. Its many advantages are largely a result of the incorporation of a separate switch for performing all arcing duty, a feature heretofore provided only on large ratings of Load Ratio Control and Power Regulating Transformers.

1 Arcing duty is confined to but *four* moving contacts and *two* stationary contacts per phase, through use of a separate Load Transfer Switch. Current is actually interrupted on but one moving and one stationary contact per phase in changing from one operating position to another. Photo shows front half of switch.

2 No arcing duty is imposed upon any of these Tap Selector Switch contacts, avoiding the necessity for replacement due to burning or scoring. Contacts are of hardened *copper alloy* to minimize frictional wear.



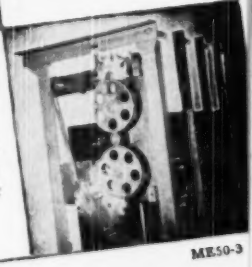
3 Greatly improved arc interrupting ability is provided through use of a separate Load Transfer Switch instead of the usual single switch arrangement which performs the dual function of breaking current and changing taps. The fewer contacts of the Load Transfer Switch make possible longer arc clearances.



4 Arcing is confined to a small area in contrast with the large area which is subjected to arcing on voltage regulating apparatus incorporating a single switch for breaking current as well as changing taps.

5 Insulating barriers in arcing area are faced with Melamine. This material is extremely resistant to the erosive action of arcs and arcing gases.

6 Wear cannot cause improper timing of the operations of the switches since not only are all parts solidly tied together by means of gears, but their timing is not critical.



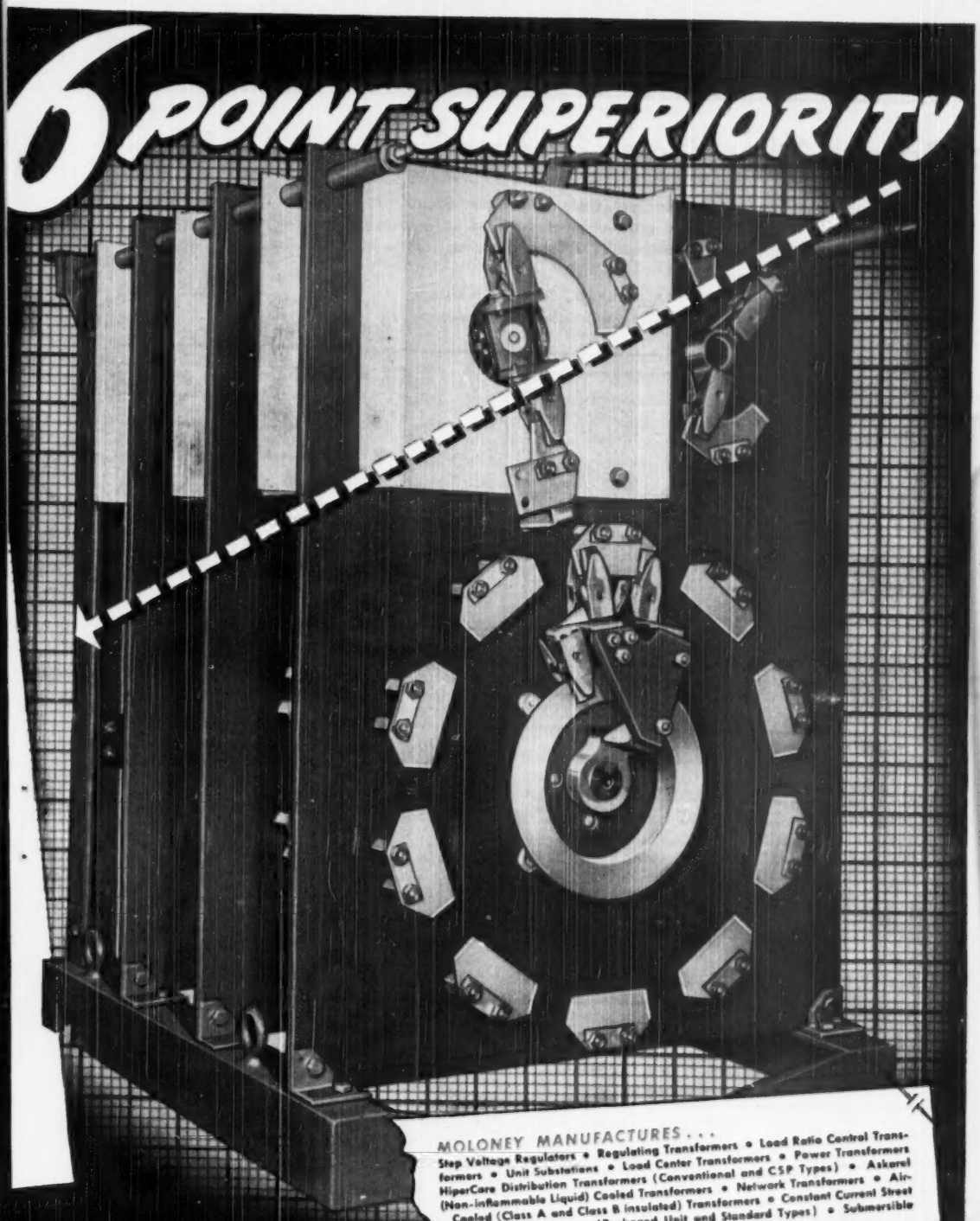
ME50-3

MOLONEY ELECTRIC CO.

Sales Offices in all Principal Cities

FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONTARIO, CANADA

6 POINT SUPERIORITY



MOLONEY MANUFACTURES . . .

Step Voltage Regulators • Regulating Transformers • Load Ratio Control Transformers • Unit Substations • Load Center Transformers • Power Transformers HiperCore Distribution Transformers (Conventional and CSP Types) • Askarel (Non-inflammable Liquid) Cooled Transformers • Network Transformers • Air-Cooled (Class A and Class B insulated) Transformers • Constant Current Street Lighting Transformers (Packaged Unit and Standard Types) • Submersible Type Transformers • Capacitors

Power Line Carrier Application Data

Characteristics of coupling capacitors, cable lengths for attenuation at various frequencies, decibel losses in coaxial cable and attenuation of overhead power circuits, also measured attenuation and input resistance and capacitance at 100 kc of various lengths of coaxial cable are presented

R. C. CHEEK, Central Station Engineer
Westinghouse Electric Corp, East Pittsburgh, Pa.

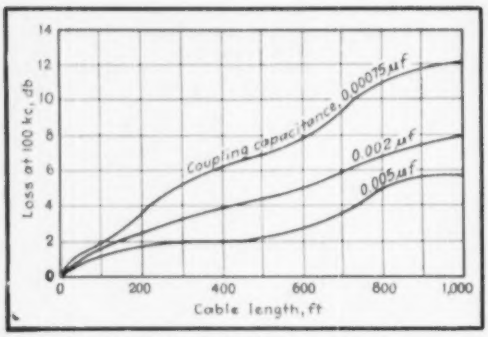


FIG 1—MEASURED ATTENUATION at 100 kc of various lengths of coaxial cable operating directly into 900-ohm resistive load through coupling capacitances shown. No impedance matching transformer used

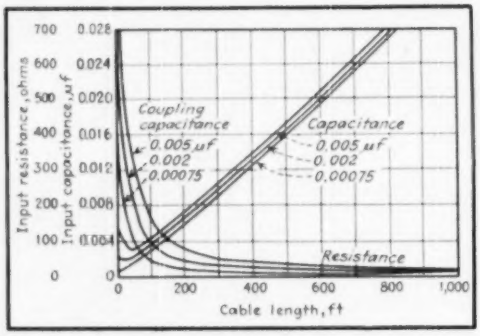


FIG 2—INPUT resistance and capacitance (R—jX$_c$) at 100 kc of various lengths of coaxial cable operating directly into 900-ohm resistive load through coupling capacitances shown. No impedance matching transformer used

TABLE I—Characteristics of Typical Coupling Capacitors

System voltage, kv	Average coupling capacitance, μf	Average capacitance of tap for in-phase potential device, μf	Low Frequency Test, rms kv		Impulse Test Crest kv, (+) or (−) 1.5x40 μsec Full Wave
			One Min Dry	Ten Sec Wet	
46	0.004	0.0205	110	100	250
69	0.00275	0.0225	165	145	350
92	0.002	0.0205	215	190	450
115	0.00187	0.0225	265	230	550
138	0.00137	0.0225	320	275	650
161	0.00125	0.0225	370	315	750
230	0.00094	0.0225	525	445	1050
287	0.00075	0.0225	655	555	1300

Note: If in-phase potential device is used, total capacitance for carrier is tap capacitance in series with coupling capacitance. If in-phase potential device is not used, tap capacitance is short-circuited.

TABLE II—Recommended Maximum Cable Lengths from Coupling Capacitor to Terminal Equipment for 1 db and 2 db Attenuation at 50, 85 and 150 kc. Matching Transformer Used Without Tuning Equipment

Coupling Capacitance, μf	Maximum Cable Length, ft					
	For 1 db Attenuation			For 2 db Attenuation		
	50 kc	85 kc	150 kc	50 kc	85 kc	150 kc
0.00075	150	180	200	300	350	410
0.001	200	230	250	390	430	600
0.0012	240	270	300	430	500	750
0.0015	260	300	340	500	600	800
0.002	360	390	460	680	800	1000
0.003	450	450	475	900	1000	1000
0.006	800	800	800	1000	1000	1000

TABLE III—Approximate Losses in Carrier Coaxial Cable

Frequency, kc	Loss db per 1,000 ft
20	0.2
50	0.32
100	0.5
150	0.6
300	0.9

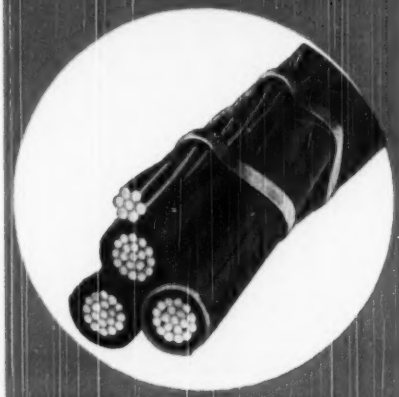
TABLE IV—Approximate Carrier Attenuation of Overhead Power Circuits

Line voltage, kv	Approximate Attenuation, db per mile									
	Phase-to-phase coupling					Phase-to-ground coupling				
	20 kc	50 kc	100 kc	150 kc	300 kc	20 kc	50 kc	100 kc	150 kc	300 kc
230	0.03	0.05	0.075	0.107	0.2	0.04	0.062	0.094	0.13	0.25
138	0.041	0.065	0.09	0.12	0.215	0.051	0.081	0.113	0.15	0.27
115	0.05	0.075	0.102	0.135	0.27	0.062	0.094	0.130	0.16	0.34
69	0.055	0.08	0.11	0.145	0.29	0.069	0.100	0.137	0.18	0.36
34.5	0.073	0.10	0.13	0.18	0.38	0.094	0.125	0.16	0.22	0.47
13.8	0.12	0.15	0.18	0.215	0.45	0.15	0.19	0.22	0.27	0.56

Adapted by permission of Westinghouse Electric Corp from forthcoming *Electrical Transmission and Distribution Reference Book*, 1950 edition.

SIMPLEX-ANHYDREX AERIAL CABLES

KEEP OVERHEAD DISTRIBUTION COSTS AT DOWN-TO-EARTH LEVELS



Self-Supporting Type
Bound at the Factory to Supporting Messenger

Installing Cables by Spinner Method

SIMPLEX
WIRES & CABLES
SIMPLEX WIRE & CABLE CO.
79 Sidney Street
CAMBRIDGE 39, MASS.

Wherever the installation, whatever the service conditions, Simplex-ANHYDREX Aerial Cables provide a sure-fire means of cutting the cost and improving the performance of overhead distribution systems.

Anhydrex insulated, neoprene jacketed, and designed for installation by either the self-supporting or spinner methods, they furnish a wealth of advantages over open wire lines — advantages that mean uninterrupted service year in and year out plus big savings on installation and maintenance. Some are listed below, but there are many others you'll want to know about. All are described in the Simplex Aerial Cable Catalog which we will gladly send to you upon request. Simply fill in and mail the coupon below.

ADVANTAGES FOR INSTALLATION

- Less labor needed to install
- Can be installed on existing pole lines
- Crossarms not needed
- More circuits per pole
- Low congestion on poles; phases and neutral assembled together
- Little or no tree-trimming required
- Smaller clearances needed
- Unrestricted cable routing
- Attractive appearance

OPERATING ADVANTAGES

- Better regulation
- Anhydrex insulation has high dielectric strength, low power factor and low dielectric constant
- ANHYDREX is unexcelled for resistance to moisture
- Neoprene jacket provides protection against oil, chemicals, fungus, heat and sunlight
- Neoprene resists abrasion by swaying limbs and chafing against poles
- Fewer service interruptions due to winds, icing, and lightning
- Not subject to corrosion
- Higher safety factor for people and property below
- Less maintenance required

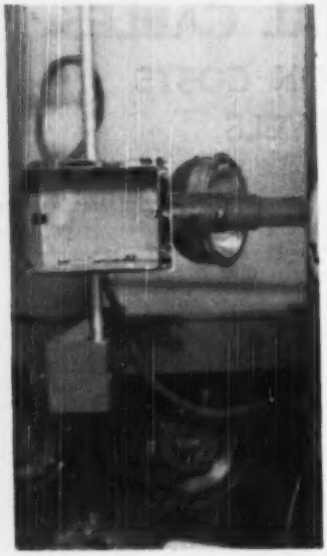
SIMPLEX WIRE & CABLE CO.
79 SIDNEY ST., CAMBRIDGE 39, MASS.

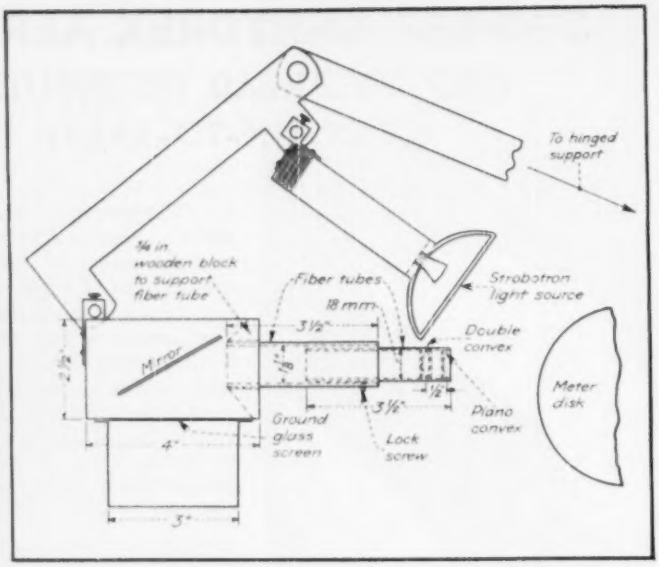
NAME_____ TITLE_____

COMPANY_____

STREET_____

CITY_____ STATE_____





STROBOSCOPIC disk viewer for testing and calibrating watthour meters is responsible for the increased volume of meters tested in Hudson Division shops of Public Service Electric & Gas Co. Eighth power image of rotating meter disk is reflected on ground glass screen

Stroboscopic Viewer Aids Watthour Meter Testing

EDWARD C. LAUTEN
Polyphase Meterman
Public Service Electric & Gas Co
Jersey City, N. J.

FACILITIES in our Hudson Division meter shop include a stroboscopic viewer wherein stroboscopic light reflected from the edge of the rotating meter disk is picked up and projected on a screen as an enlarged image.

Experience with the viewer has shown these distinct advantages:

1. All eyestrain is eliminated.

2. Ease of detecting any forward or backward motion of disk image permits more accurate testing.

3. Operator's hands are free for manipulation of controls or for adjustments.

4. Volume of testing has been increased.

The viewing unit consists of two lenses mounted in an adjustable fiber tube, a mirror for changing the angle of reflection, and a ground glass screen for viewing the eighth power enlarged image. These parts are housed in a light gage aluminum box. Their physical arrangement is shown in the diagram.

The viewer and strobotron light source are mounted on a swinging arm to the left of the meter under test. This location is advantageous since there are many meters whose disks are not visible from the front. The angle between light source and viewer is fixed so that complete unit may be moved easily in and out of test position. Only adjustment required is the vertical positioning of the lens tube on a horizontal plane with the meter disk. Edge of the meter disk may be seen continuously.

Simple Wiring Scheme Reduces Motor-Starter Costs

FRANK E. REEVES
Power Plant Design Engineer
Barnard and Burk
Baton Rouge, La.

THIS SIMPLIFIED wiring scheme saved approximately $500 in equipment costs in a power plant motor control center by providing green pilot light indications without the necessity for the usual normally-closed contacts for their control. The scheme is shown in the elementary diagram. It would also be applicable to any control center having a large number of motor starters, such as a large industrial plant or power plant where the cost of extra auxiliary contacts for indicating lights is a substantial item. The principle is the same as that used for supervising the trip coil of a power circuit breaker by connecting the red light in series with it.

The voltage across the green light when the contactor is in the open position is determined principally by the ratio of the resistance of the lamp and its associated resistor or transformer, to the impedance of the operating coil. The fact that the red lamp is across the coil has a negligible effect on the voltage division. With the armature or plunger of the contactor in its normal or open position, the large air gap in the magnetic circuit causes the coil to have much lower im-

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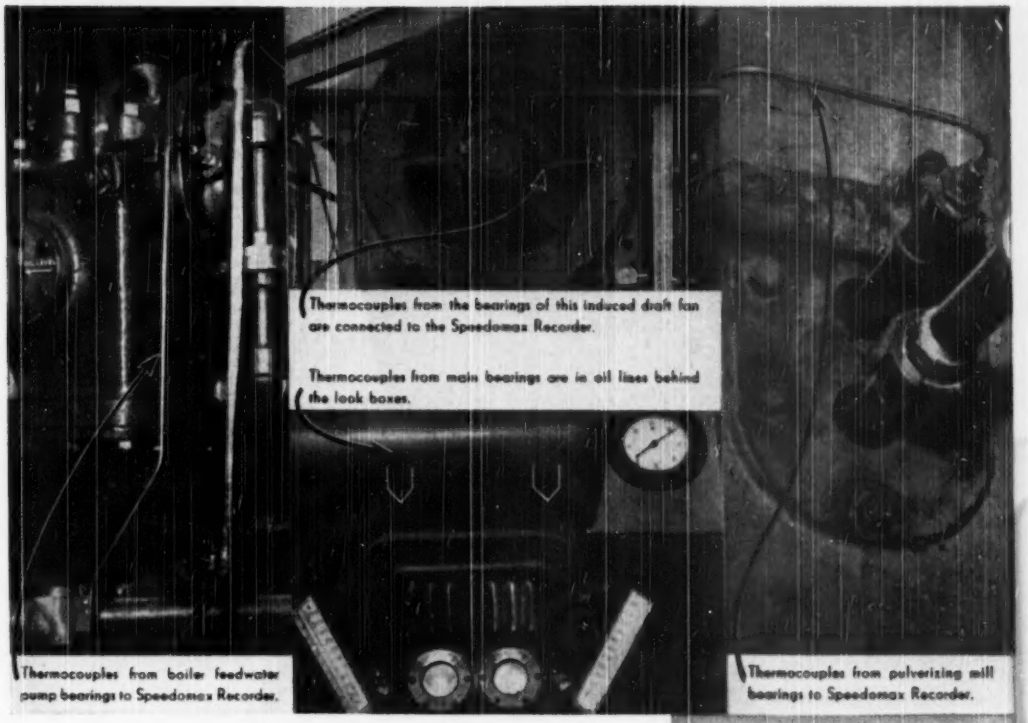

Thermocouples from the bearings of this induced draft fan are connected to the Speedomax Recorder.
Thermocouples from main bearings are in oil lines behind the look boxes.
Thermocouples from boiler feedwater pump bearings to Speedomax Recorder.
Thermocouples from pulverizing mill bearings to Speedomax Recorder.

Temperature From These 4 Points

. . . And 156 More . . .

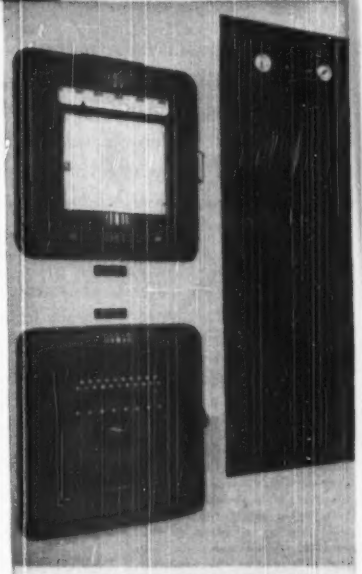
At ONE Speedomax Recorder

Remarkably fast, this new Speedomax offers a definite advance in temperature checking and recording. With Speedomax, an operator can "tour" the temperatures of 160 points in a little less than eleven minutes. He can watch readings as they are automatically indicated; or Speedomax will record them for later examination and for the shift log.

Readings are supplied in such rapid rotation, that it is generally possible to spot any high or low temperature as soon as it develops. In addition, greater operating efficiency is obtained because of the centralization of instrument readings.

The installation procedure is entirely standard. The company's staff simply installs thermocouples at those points from which they desire temperature readings. Couples are connected to the Speedomax equipment in banks of 20 each, with as many as eight banks. Appropriate alarms may be included.

For further information about this versatile temperature checking equipment, simply write for your copy of Folder ND46-33A(1). Address Leeds & Northrup Co., 4938 Stenton Avenue, Philadelphia 44, Penna.

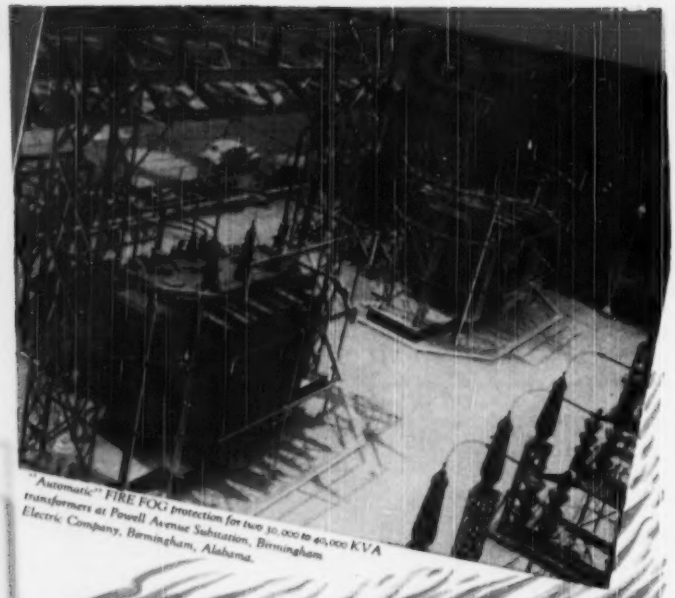


Speedomax Recorder for all points shown and enough more to record a total of 160.

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

LEEDS & NORTHRUP CO.

Jrl. Ad ND46-33A(2)



"Automatic" FIRE FOG protection for two 30,000 to 40,000 KVA transformers at Powell Avenue Substation, Birmingham Electric Company, Birmingham, Alabama.

Ready, Willing and Able
TO COMBAT ELECTRICAL EQUIPMENT FIRES

Only a hint of flame at this bank of high voltage transformers and—quick as a flash, *Automatic* FIRE FOG goes into action. From strategically positioned nozzles, a concentration of fine water spray is directed at the blaze. Flames are forced down . . . the fire area cooled. In but a matter of seconds, extinguishment is complete and damage to equipment confined only to the point of fire origin. Even out-of-service time has been held to a minimum.

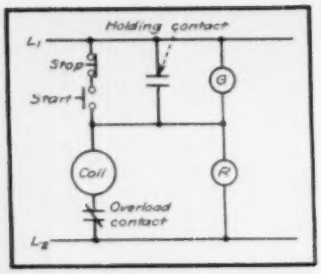
. . . a famous member of the *Automatic Sprinkler* Family . . . provides basic fire protection for process equipment and storage in the chemical and petroleum industries. On-the-spot protection for quench tanks, dryers, explosive hazards, conveyor openings, air filters, oil filled electrical equipment and other units vital to production line operations.

Although a relatively new development, *Automatic* FIRE FOG is widely recognized by both utility companies and private users. Designed specifically for your particular risk it is electrically safe and carries the approval of all leading insurance authorities.

More detailed information, especially as to how *Automatic* FIRE FOG can serve your needs is available upon request and surveys and estimates will be furnished without cost or obligation. Write today.

"AUTOMATIC" SPRINKLER CORP. OF AMERICA
YOUNGSTOWN 1, OHIO

"Automatic" Sprinkler
FIRST IN FIRE PROTECTION
DEVELOPMENT • ENGINEERING MANUFACTURE • INSTALLATION
OFFICES IN PRINCIPAL CITIES OF NORTH AND SOUTH AMERICA



WIRING SCHEME of cost-saving method for obtaining a green light indication without an auxiliary contact in the motor starter

pedance than when the coil is energized at full line voltage. It is this fact that causes the "inrush" current to the operating coil to be from four to five times the "holding" or "sealed" current when the air gap is closed after full energization.

Low energy lamps work out best in this scheme as they will command a larger proportion of the total control voltage. A common type of low-drain indicating lamp with its standard series resistor for use on 115 v has a resistance of approximately 3,000 ohms for the combination. The table gives the voltage distribution in the circuit when such a low-energy lamp is used. Coil data were taken from a typical motor-starter bulletin for 3-pole units. Volt-ampere "inrush" values were used for determining coil impedances. The motor is assumed not running.

The green light will, of course, be shorted out when the motor is started. In the case of a motor-starter equipped for 3-wire control such as is shown in the diagram, the holding contact does the shorting. When 2-wire control is used, the maintained contact control switch or the control device such as a thermostat or pressure switch performs the same function.

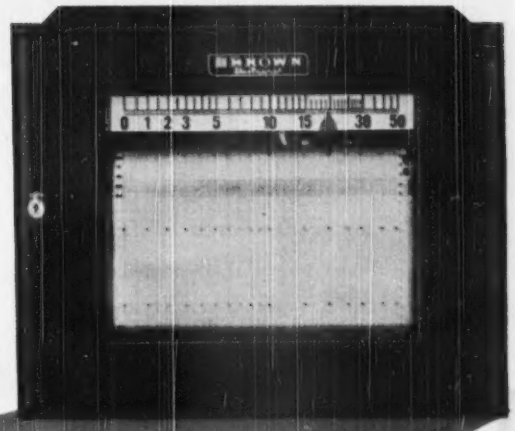
Essentially the same ratio of volt-

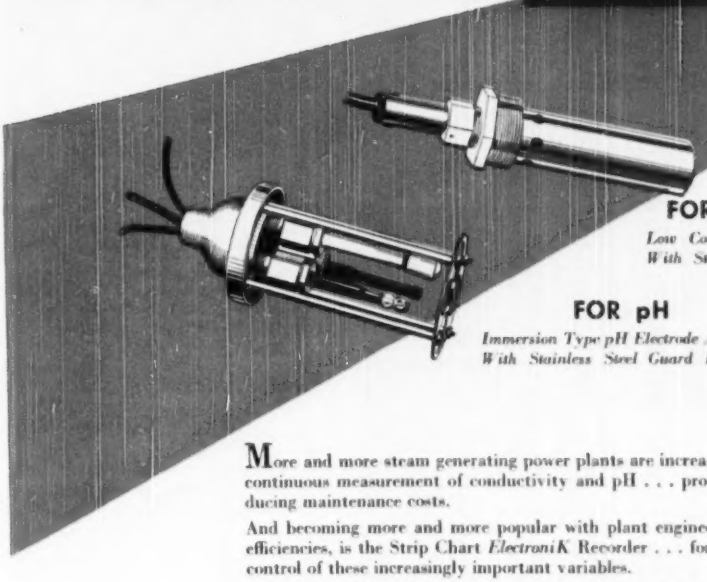
Voltage Division in Motor Starter Circuit with Motor Shut Down (Control Voltage 115)

Size of Starter	Impedance of Operating Coil	Voltage Across Operating Coil	Voltage Across Green Light and Series Resistor	% of Total Voltage Across Green Lt. & Res.
00	142 Ohms	5	110	95
0	102 "	4	111	97
1	142 "	5	110	95
2	84 "	3	114	99.3
3	14.3 "	0.5	114.5	99.7
4	8.53 "	0.3	114.7	99.8
5	3.8 "	0.2	114.8	99.9

NO MATTER HOW YOU LOOK AT IT . . .

This *ElectroniK* RECORDER Can Improve Your Operating Efficiency





FOR CONDUCTIVITY

Low Constant Conductivity Dip Cell With Stainless Steel Protecting Tube.

FOR pH

Immersion Type pH Electrode Assembly With Stainless Steel Guard Housing.

More and more steam generating power plants are increasing their operating efficiencies with continuous measurement of conductivity and pH . . . protecting valuable equipment and reducing maintenance costs.

And becoming more and more popular with plant engineers, to help attain higher operating efficiencies, is the Strip Chart *ElectroniK* Recorder . . . for continuous recording or automatic control of these increasingly important variables.

Whether it be the recording and control of pH in water conditioning . . . or the measurement of conductivity in determining a concentration of electrolytic contaminants . . . the *ElectroniK* Recorder can be relied on for unusual sensitivity, for speedy response, for accurate and permanent record, and for locating potential sources of trouble.

No matter how you look at it, a *positive* check on conductivity and pH with this *ElectroniK* Recorder can help boost *your efficiency*.

Write for Bulletin 15-12 or call in your local Honeywell engineer for a discussion of your conductivity and pH problems . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4568 Wayne Ave., Philadelphia 44, Pa. Offices in more than 80 principal cities of the United States, Canada and throughout the world.

Honeywell

BROWN INSTRUMENTS

MOSINEE doesn't count its success in terms of big volume records. More important to us is the aid that MOSINEE "paperologists" and facilities provide our customers.

If you have a problem involving paper . . . if you require specific technical characteristics such as high tensile or tear strength, accurate caliper, density, liquid repellency or absorbency, good dielectric strength, specified pH for maximum-minimum acidity or alkalinity . . . and above all, if you want to be sure of *dependable uniformity* . . . it will pay you to specify "MOSINEE." For consultation with MOSINEE technicians, without obligation to you, please write Dept. EW.

MOSINEE

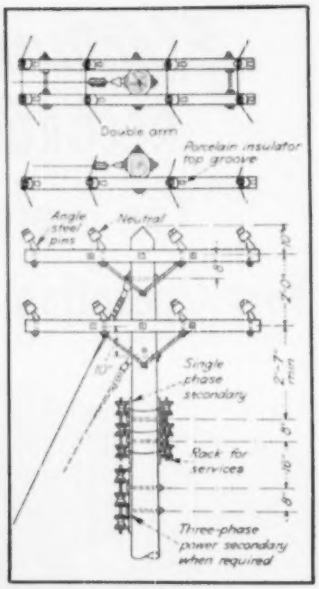
"More than Paper"

MOSINEE PAPER MILLS CO. MOSINEE, WISCONSIN

MOSINEE PAPER MILLS COMPANY • MOSINEE, WISCONSIN

"Essential Paper Manufacturers"

ages would exist for higher control voltages since series resistor values and operating coil impedances would increase in the same relative ratios.



STEEL PIN angle construction, single and double arm, is expected to reduce the number of double-arm, complete deadend installations used by Cincinnati Gas & Electric Co

Steel Pins Simplify Angle Construction

APPLICATIONS of both angle and straight steel pins have simplified and cut the cost of angle construction on the Cincinnati Gas & Electric Co system. Double arm steel angle-pin construction is used for the following:

Wire Size	Max Tension (pounds)	Line Angles (degrees)
No. 6 WP	720	40–50
No. 2 WP	1,160	40–50
No. 2/0 WP	1,810	25–50

For lesser angles, single arm steel angle pin construction is used as follows:

Wire Size	Max Tension (pounds)	Line Angles (degrees)
No. 6 WP	720	20–40
No. 2 WP	1,160	16–25
No. 2/0 WP	1,810	10–25

For angles below 50 deg not shown in the tables, double-arm straight

The ADVANCED DESIGN FEATURES of the

KEARNEY Type "T" TRIP-OUT

200 AMPERE

Assures You of

Better Protection

of Equipment on Lines
Up to 15,000 Volts

Here's why—

- Silver to silver contacts for heavy loads
- High conductivity copper current path through switch
- Floating top contact to assure proper contact alignment
- Fuse cartridge opens at both ends—assures rapid expulsion of arcing gases and high interrupting capacity
- Wide cartridge hinge assure proper contact engagement when switch is closed

For complete detailed information including prices, write today.

JAMES R. KEARNEY CORPORATION
JAMES R. KEARNEY CORPORATION - 4224-42 Clayton Ave., St. Louis 10, Missouri
Canadian Plant: Guelph, Ontario

BETTER CONSTRUCTION Safer MAINTENANCE

C-O-TWO ANNOUNCES

Underwriters' Laboratories, Inc. Listed

Low Pressure Carbon Dioxide Type Fire Extinguishing Systems

ECONOMICAL, EFFICIENT FIRE PROTECTION

from a single storage tank

C-O-TWO now adds another outstanding contribution to modern fire fighting . . . *C-O-TWO Low Pressure Carbon Dioxide Type Fire Extinguishing Systems.* Carbon dioxide stored in bulk under low pressure, means greater fire protection for your larger size fire hazards at less cost.

Flexibility is the keynote of these new type C-O-TWO Fire Extinguishing Systems . . . the low pressure carbon dioxide storage tanks range in capacities from one to fifty tons, and can be operated as straight manual, partially automatic or fully automatic systems.

Flammable liquids, electrical equipment, storage and manufacturing processes can all be made firesafe from a single low pressure carbon dioxide storage tank. If fire strikes the system quickly goes into operation and the fast-acting, non-damaging carbon dioxide extinguishes the blaze in seconds.

COMPLETE CARBON DIOXIDE FIRE PROTECTION

With this new addition C-O-TWO offers complete, fully approved carbon dioxide fire protection . . . hand portables, wheeled portables, hose units, high pressure cylinder systems and low pressure storage tank systems. Whether your fire protection problem is a factory, mill, warehouse, power station or research center you have the assurance of the best type equipment for the particular fire hazard concerned.

Let an experienced C-O-TWO Fire Protection Engineer help you in planning up-to-date, fully approved fire protection now before fire strikes. Complete free information and descriptive literature available on request. Get the facts today!

C-O-TWO FIRE EQUIPMENT COMPANY

NEWARK 1 • NEW JERSEY

Sales and Service in the Principal Cities of United States and Canada

AFFILIATED WITH PYRENE MANUFACTURING COMPANY

steel-pin construction is used. These steel-pin designs are expected to reduce the number of double arm, complete deadend installations.

Slight reduction in flashover value on steel pins is recognized but no difficulties are anticipated from this source.

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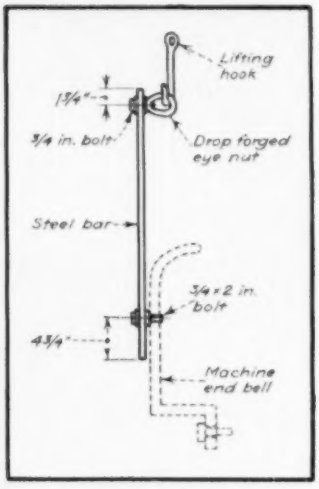


LIFTING DEVICE made of 5/16 x 2 x 30-in. steel bar and eye nut simplifies positioning of end bell during re-assembly of machine. Lifting eye nut should be directly above center of gravity of end bell for vertical hanging

Lifting Device Simplifies Positioning End Bell

L. M. JOHNSON
New England Power Co
Worcester, Mass.

REMOVING and replacing end bells can be done easily and safely by use of a lifting device designed by New England Power Co. This device keeps the end bell vertical and permits turning or swiveling the end bell to line it up with the stator.

The outfit consists of a steel bar fitted with an eye nut (see illustration). The bar is attached to the end bell by a ¾-in. bolt through a suitably drilled and tapped hole. Locating the hole so that the eye nut is directly over the center of gravity will insure a vertically hanging end bell. Many machines are drilled and tapped during manufacture so the lifting device can be quickly attached. Its use greatly facilitates handling a rather awkward piece of equipment.

An Announcement of Importance to The Electrical Industry

UNDERWRITERS' APPROVE

TRIANGLE

"DUAL-RATED" WIRE

for

RH OR RW

APPLICATIONS

IT'S "DUAL-RATED" One wire — two purposes
Reduce inventory headaches — specify "Dual-Rated" wire.

In a move of prime importance to the electrical industry, Underwriters' Laboratories, Inc., has issued an approval for Triangle's "Dual-Rated" Wire as Type RH or Type RW. This means that "Dual-Rated" wire is suitable for use as Type RH at 75°C. in dry location or Type RW at 60°C. in wet locations.

"Dual-Rated", available in sizes #14 to 1,000,000 CM, is a superior quality general purpose wire, having the following outstanding properties: extreme moisture resistance, excellent heat resistance, exceptionally long life. In sizes #14 through #6, "Dual-Rated" incorporates Triangle's famous Glazon cover. When buying wire for hot or moist locations, reduce your inventory headaches — specify Triangle's "Dual-Rated" wire.

In the long run—you'll save —and get it faster—from a Triangle Distributor.

TRIANGLE CONDUIT & CABLE CO., INC.

1902 JERSEY AVENUE • NEW BRUNSWICK, NEW JERSEY

Plants: New Brunswick, N. J. Moundsville, W. Va.

GLAZON BUILDING WIRE • BARE WIRE • ARMORED CABLE • GLAZON NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE, SERVICE DROP, VARNISHED CAMBRIC BRAIDED OR LEADED, TRIOPRENE TRENCH, POWER AND PARKWAY CABLES • RIGID CONDUIT HOT-DIPPED GALVANIZED • ELECTRIC METALLIC THIN WALL CONDUIT • FLEXIBLE STEEL CONDUIT

LOAD BUILDING

RESIDENTIAL • RURAL
COMMERCIAL • INDUSTRIAL

PAY STATION is big convenience for customers in paying electric and gas bills. Dealer gets increased floor traffic and additional business. Utility gets collection agent at practically no cost. Insert shows electric sign furnished by New Orleans Public Service to authorized pay stations. There are now 60 such pay stations collecting about 25% of bills issued

Pay Stations Aid Dealer and Customer

E. N. AVEGNO
Manager
Dealer Division
New Orleans Public Service, Inc.

AUTHORIZED pay stations at 60 appliance dealer locations in the territory served by New Orleans Public Service, Inc, not only make it convenient for customers to pay their electric and gas service bills but assist the dealers in increasing floor traffic and building business. The utility benefits by getting the additional collection agents and their facilities at very small cost. At present, more than 34,000 bills are paid at these pay stations—about 25% of the total number of bills rendered monthly. This percentage has been steadily increasing.

If the dealer meets certain requirements he is made an authorized pay station where customers may pay gas and electric service bills. He is furnished with an electric sign and several times during the year we advertise to our customers that gas and electric bills may be paid at the following authorized pay stations. The sixty stations are listed in the ad.

Must be Appliance Dealer

In order to be eligible for appointment as an agent under the "PAY STATION" plan, the dealer must be engaged in the business of selling electric and/or gas appliances, including major appliances, and must have employed at least one person whose principal duty is to act as cashier. The agent's place of business must be of sufficient size to enable him to render adequate and pleasing service to the company's customers during all business hours.

Authorized agent and the company enter an agreement whereunder the agent agrees to serve as agent for a period of one year. The agent is authorized to act only as a collection agent, to receive and receipt for payment of electric, gas and merchandise bills issued by the company. The agent must provide the desk or teller's cage, prominently identified for the purpose of receiving payments for the utility company.

The agent accepts payment in full for net bill within due date and period. He may also accept payment in full for gross bills presented within thirty days after the due date provided no arrears are shown in the "Previous Amount Unpaid" column.

Pay stations in New Orleans were first established in 1940. There were 52 at end of 1941. This number was reduced during the war to 12 due to difficulty in hiring personnel as well as the shortage of merchandise. After the war when appliances became more plentiful the dealers realized the value of the pay stations in increasing floor traffic and creating additional business. We did not have much difficulty in re-establishing most of the old stations and have increased the total number as of April first to 60.

"Big E" Selling Drive Keyed To Benefits

LE ROY MACLEOD
Advertising Manager
New York State Electric and Gas Corp

CALLED the "Big E" plan, a load-building activity recently started by the New York Gas and Electric Corp emphasizes cooperation between the power company and appliance dealers to raise the sales of energy-using devices. It's a long-range project for the company, designed to keep growing load in step with constantly increasing generating capacity. Advance publicity put in dealers' hands has played up the fact that the company has plans for an adequate future power supply. It shows how dealers can cooperate and sell enough equipment to justify this in-

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

A Quick Changer!

. . . for fast re-fusing . . for higher capacity

Interchangeability keynotes Westinghouse porcelain-enclosed cutouts. Only Westinghouse gives you this versatility in line protection. Consider what this means:

First, fuse replacements are fast . . . safe . . . easy. Lineman removes door with hookstick—replaces it with a fused door. Fuse links can be replaced at the truck or in the shop.

Second, as line capacity outgrows the cutout interrupting rating, the EA cutout door may be replaced with the new Type HC (high interrupting capacity) door—either dropout or non-dropout type. That's because *any* door will fit *any* housing.

In addition, you get greater safety; complete hookstick operation; 180° dropout for clear indication of blown fuse; cool operation; light weight combined with great mechanical and electrical strength.

These cutouts are available now in a range of sizes to meet your requirements. See the versatility of this cutout. Ask your nearby Westinghouse representative or distributor for a personal demonstration and Booklets B-3833 and B-4299. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-60705A

1. PRESTITE PORCELAIN HOUSING—50-ampere, 5-kv, identical for both Type EA and Type HC cutouts.

2. MOLDARTA TYPE EA DOOR—1,200-ampere interrupting capacity.

3. MOLDARTA TYPE HC DOOR—Interchangeable with Type EA cutout door. Interrupting capacity 8,000 amperes at 2,500 volts, 5,000 amperes at 5,000 volts.

Westinghouse

FUSE CUTOUTS

FOR ANY SYSTEM

crease in capacity, while helping to keep the appliance business growing.

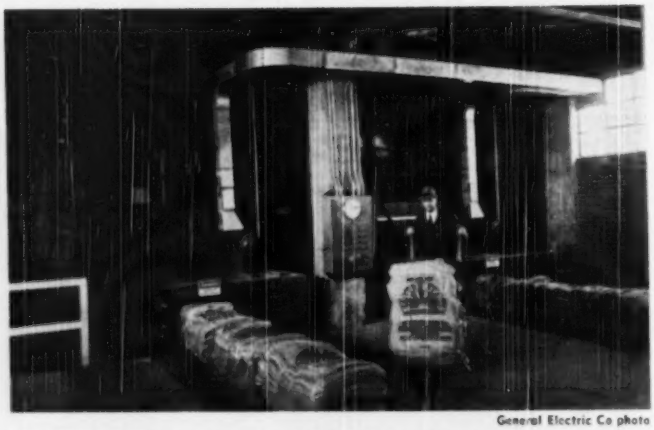
"Big E", as a title, is intended to appeal to the public because "E" stands for Economy, Ease, Emancipation from drudgery, and Enduring style. These, and other alphabetical connotations, are the central themes of the heavy advertising campaign the company has started on behalf of appliance sales. An initial intensive campaign which has run since April 1 ended July 15. Another is planned for the fall, and "Big E" will be a regular company operation from now on.

Experienced contact men were assigned, as the first move, to advise dealers on sales problems, supply them with display cards and folders, arrange sales meetings, and keep records of appliance sales. They do not do any selling themselves, but act in advisory capacities. Extensive literature has gone to all dealers explaining the hows and whys of the "Big E", special stress being laid on the fact that the fortunes of both dealer and company depend on close cooperation. The company can't expand capacity without greater equipment sales, and people won't buy more equipment unless there's more power.

The company informed the dealers of its plans for radio and newspaper advertising, displays in its windows, and direct mail handouts. This it did by sending proofs and schedules of ads, plus copies of radio commercials, with an invitation for the retailers to join in this campaign. It also laid down plans for its farm and home service departments to provide demonstrations in school classrooms, aid in planning individual family electrical requirements, and conduct school and store lighting campaigns.

An added feature is the company's plan to contribute toward campaign incentives for dealer salesmen who sell the most appliances.

New York State Electric and Gas serves 350,000 customers in upper New York state. Before the war it merchandised a number of electric appliances, but when production was resumed, it decided to allow dealers to get the full advantage of the renewed output. Now it has decided to start the cooperative plan over a long period of time as a replacement for direct merchandising.



General Electric Co photo

DIELECTRIC OVEN, used to sanitize burlap feed bags, saves farmers approximately one million dollars a year by permitting re-use of bags. This method does not injure burlap and is more effective against spreading livestock and poultry diseases than other methods used. Ovens are 60-kw and produce 13 million cps heat

ELECTRICAL ENGINEERING IN INDUSTRY

Dielectric Ovens Sanitize Feed Bags

ONE MILLION DOLLARS a year are saved Eastern States farmers by the use of dielectric ovens in sanitizing burlap feed bags for re-use by the Buffalo, N. Y., Eastern States Farmers Exchange, Inc, feed manufacturer.

By subjecting bags to high frequency heat, the new process literally "cooks" disease organisms to death.

The new process will help the farmer safeguard against spreading livestock and poultry diseases through the re-use of feed bags.

Although a chemical process pioneered by Eastern States had long been considered the best of its kind, considerable improvement in bag sanitization appears certain by using high frequency dielectric heat.

The dielectric sanitizing ovens are approximately 60 ft long and each is rated at 60 kw. High frequency energy of 13 million cps uniformly heats the bales of 250 bags.

The dielectric heating process has no apparent detrimental effect on the life or soundness of burlap. Some of the chemicals tried in the quest for better or more economical sanitizing methods, on the other hand, have damaged burlap. Steam, too, because it moistens the fibers, was also found to be destructive. But saturation with dry heat produced by high-frequency power is not injurious.

Re-use of feed bags is by no means a small item in Eastern States service. The mill uses 50,000 bags a day. Once in service, each feed bag, by making repeated trips carries 500 to 800-lb of feed to members' farms. This used-bag program makes the cost of packaging 100 lb of feed about 6¢. The program of re-using bags makes the cost of packaging feeds considerably less than it would if feed were shipped in new bags.

Load Building Notes

● Investigation of the possibilities of dielectric heating for drying corn, alfalfa and rice is being made by USDA engineers. The corn and alfalfa studies are under way at the Nebraska experiment station.

● To give emphasis to the statement that electric cooking is cool cooking, Pennsylvania Power & Light ran a newspaper ad showing a bathing beauty seated on top of an electric range. "Could you do this with the oven turned on in your old-style cook stove?" asks the ad.

WHEREVER YOU USE WOOD...

IN THE SOUTH, prolonged high temperatures cause light-bodied preservatives to leach and evaporate from the wood, thus exposing the wood to termite attack and decay. Barrett* Coal-Tar Creosote, heavier bodied and of lower volatility, prevents this condition. It stays in the wood longer under all conditions—doesn't "run out" on the job.

IN THE NORTH, poles must resist the tremendous weight of frequent sleet storms. Avoid preservatives which *weaken* the wood. BARRETT Coal-Tar Creosote allows poles to retain their maximum strength, and helps to keep the poles at their best and hold the lines aloft.

IN THE DESERT, crossties broom, shatter and split from extreme dryness and heat. Solutions made with BARRETT Coal-Tar Creosote retard this, and also reduce mechanical wear of crossties through their lubricating action on the wood fibers. In poles, heavy treatment with BARRETT Coal-Tar Creosote substantially reduces checking and splitting.

IN THE SWAMPS, forces of decay are almost at their maximum of destructive power. High moisture content and infection from other decaying wood and debris are ever-present menaces. Poles properly treated with BARRETT Coal-Tar Creosote have survived under swamp conditions for years.

IN FRESH WATER, many preservatives leach out of wood. BARRETT Coal-Tar Creosote resists this leaching action. Being only negligibly soluble in water, it is the preferred preservative for use on submerged wood structures, or those exposed to the powerful action of rapidly flowing water.

IN SALT WATER, marine wood-borers give a preservative its severest test. Of hundreds of preservatives that have been tried through the years, *Coal-Tar* Creosote is the only one that has proved consistently effective against teredos, limnoria and other salt-water enemies of wood.

THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

Use Barrett*

*Reg. U. S. Pat. Off.

Only coal-tar creosote wood preservative has been used long enough and widely enough to have proved its effectiveness under all conditions.

COAL TAR CREOSOTE

CHANCE type KM Cutout

"Kick-Out"* Operation—Cuts Costs

The Chance KM Cutout KICKS OUT at the bottom after fault—a mechanical development that not only gives positive indication, but adds these cost cutting advantages:

1. **Longer Life Fuse Tube**—No water in tube after fault—No warping—Fast mechanical ejector—No link hang-up inside tube.
2. **No Link Breakage**—No stress on link in closing.
3. **Longer Life Contacts**—No pitting—Arc extinguished before contact breaks.

Only Chance Type KM Cutouts have this two way operation and all these plus features:

1. Non-corrosive concealed ejector spring.
2. Heavy Castings.
3. Sleet shields over all moving parts.
4. Accessible cast-in terminal lugs.
5. Pivotal mounting bracket. (E.E.I.-NEMA)
6. Arc gas deflector.
7. Meets all NEMA requirements.

ABC INDUSTRIES

No name is RIGHT when you specify CHANCE

A. B. CHANCE CO.

CENTRALIA, MISSOURI • SAN FRANCISCO, CALIFORNIA

INDUSTRIAL BRIEFS

Electric Capstan car puller cuts labor costs and expedites movement of freight cars at the Ross Milling Co, Ottawa, Kansas. It is necessary to provide means for moving one or more cars to different locations on the siding.

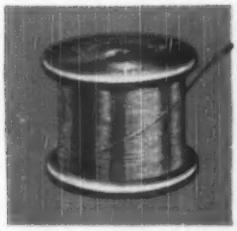
The puller employs a 7½ hp motor and one man can move a car with it at the rate of up to 45 fpm. Before the electric car puller was installed, cars were moved by several laborers utilizing pinch bars—moving the heavy loaded cars a fraction of an inch at a time.

Capacitors Save $2,630 a year at the Pickering Lumber Corp, Standard, Cal. In 1939 a 420-kva capacitor bank was installed at cost of $4,400. They raised power factor from 72 to 96%, saved penalty for operating below 80%, and made the company eligible for a bonus instead. In 1946, the addition of a 400-kva bank permitted adding 2,100 additional hp to the system having a connected load of 3,400 hp.

Electric Preheaters and burner reservoir heaters permit heavier lower-cost grades of fuel oil to be used at the Polk Sanitary Milk Co, Indianapolis, Ind. These heaters have quickly paid for themselves in fuel oil savings. Two 10-kw circulation heaters are installed at the oil storage tank which feeds two 225-hp boilers. One of these operates 24-hr daily, 7 days a week. The second heater cuts in and out automatically as needed. Electric heat was chosen for its inexpensive operation and freedom from maintenance.

High Intensity Stadium Lighting cost at Denver University is offset by the advantage gained in prestige in public reaction alone according to the university officials. The new enclosed type floodlighting units installed on steel towers are much easier and safer to maintain and service than the old units—many of which were open type and are mounted on wooden poles. New system has 264 1,500-w units producing approximately 65 ft-c. Old system had 96 1,500-w units and provided only 16 ft-c.

a "live wire" for *hot* spots



Vitrotex* Magnet Wire with Flexible Glass Insulation withstands temperatures of 130°C.

Highly Flexible . . . Amazing Space Factor — made possible by insulation of alkali-free glass, the insulation that's soft as silk and strong as steel!

High Dielectric Strength and Smooth Surface . . . resists moisture, acids, oils and corrosive vapors!

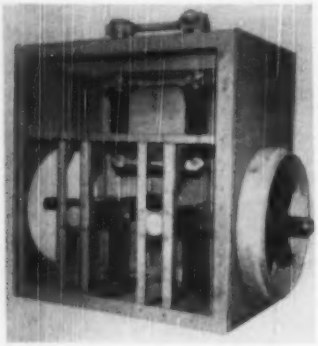
Vitrotex Windings Give Tighter, Safer Coils — for operation in confined spaces under high heat!

Ask the Anaconda Sales Office nearest you for complete information on the entire ANACONDA *Magnet Wire Line. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y., or 20 N. Wacker Drive, Chicago 6, Ill.*

*Reg. U. S. Pat. Off.

The right wire for the job ANACONDA WIRE AND CABLE

NEW EQUIPMENT



Phase Isolated Disconnect

GENERAL CONSTRUCTION of the metal enclosed, phase isolated, 69-kv, 1,500-amp disconnecting switch follows that of the phase isolated bus structure itself. The switch is reported to withstand 160 kv, 60 c, for one minute, between live parts and ground, with the blade closed or in any intermediate position to full open. Flashover across the open gap is in excess of the flashover to ground.

The double contact blade carriage is operated through screw thread drives, and is guided to assure contact seating for all mounting positions of the switch. Three single-pole units are mechanically interconnected for group operation. The bevel geared drive shafts are operated with a single handle. Grounding blades are provided but not shown.

Railway and Industrial Engineering Co, Greensburg, Pa.

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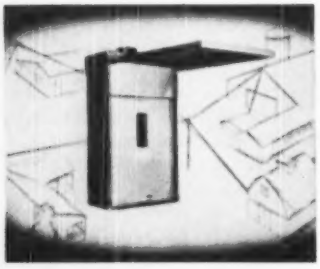

Outdoor Service Center

CONSISTING of heavy-duty F&K frame circuit breakers inside a weather-proof sheet steel enclosure, a new outdoor service center is adaptable for farmstead wiring where the meter service control can be mounted on a yard pole. Where pole metering is not feasible, the centers can be mounted with the meter on the outside of a building.

The service centers are available in 70, 90, 100, 125, 200, and 225-amp ratings at 125/250 v ac or dc; 250 v ac 3-wire, two-pole with neutral; 250 v ac, 4-wire, three-pole with neutral; straight two or three-pole for 250 v ac or dc, or three-pole 230 v ac, 575 v ac.

Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

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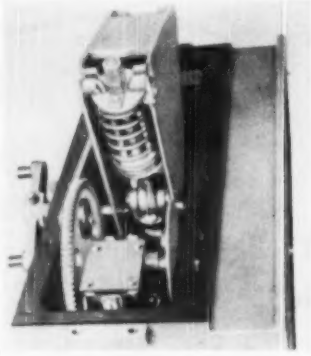


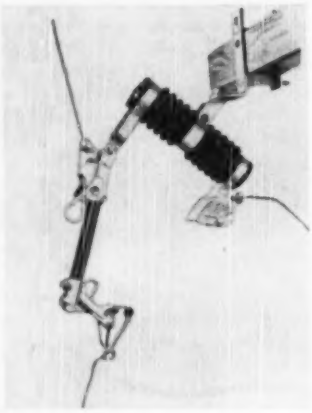
Transfer Mechanism

SELECTIVE automatic transfer mechanism, Model E6, incorporating remote operator control of feeder selection, has been developed for use with the company's load break oil switches. With one feeder selected as "preferred" and the other as "emergency," the mechanism will automatically transfer load to the "emergency" upon failure of the "preferred"—and back to "preferred" when that feeder is re-energized.

Because the operator can select from a remote location which of the feeders will be "preferred" and which "emergency," load may be transferred at will between the two feeders to balance feeders during periods of peak demand or to isolate one feeder for repairs or maintenance.

The mechanism housing is mounted directly on the supporting frame of Type RA switches in 5,000, 7,500, and 15,000-v ratings. Bulletin DA50-E6M contains a detailed description.

G & W Electric Specialty Co, 7780 Dante Ave, Chicago 19, Ill.



Distribution Cutout

RECOMMENDED for distribution systems where interrupting capacity up to 2,000 amp is required, Type KM "Kick-Out" cutout is said to tell at a glance whether it has been opened as a disconnect or by a protective operation.

Moving parts at top and bottom of the cutout assembly are shielded from ice accumulations. When the fuse link blows, the lower end of the fuse tube swings away from the contact, leaving the tube suspended by its closed end. This type of operation prevents moisture from entering the fuse tube. When in the closed position, the fuse link is stated not to be subjected to shock or additional tension.

A. B. Chance Co, Centralia, Mo.

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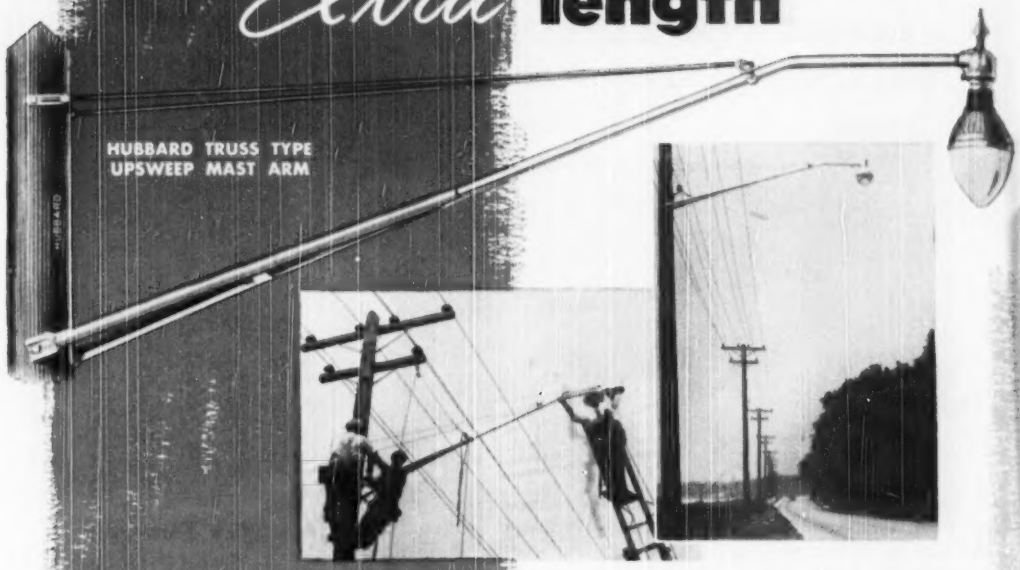
Utility Truck Bodies

A NEW LINE of utility and telephone line construction and maintenance bodies features a multiple-choice standard auxiliary equipment system. The

Extra strength ... for *Extra* length



CHECK THESE ADVANTAGES

- ✓ Exceptional strength . . . four-way triangular truss arrangement.
- ✓ Require small pole mounting space.
- ✓ Meet all EEI-NEMA specifications.
- ✓ Simplicity of design means low cost.
- ✓ "Free flowing" internal wiring — beveled pipe ends — no sharp bends — no obstructions.

Hubbard Truss Type Upsweep Mast Arms embody the features which Hubbard has pioneered in other members of the "Upsweep" arms and brackets. In the three years since their introduction they have received wide acceptance with the Electrical Industry because of the special and desirable features which they possess.

The No. 3944 series has exceptional strength in all sizes, greatly in excess of the most severe service requirements. Six-inch threads at both ends of supporting rods provide leveling and lift adjustment. The Arms may be used with internal or external wiring.

HUBBARD AND COMPANY

ESTABLISHED 1843

PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA

"Hang the Load on Hubbard Hardware!"

EISLER TRANSFORMERS

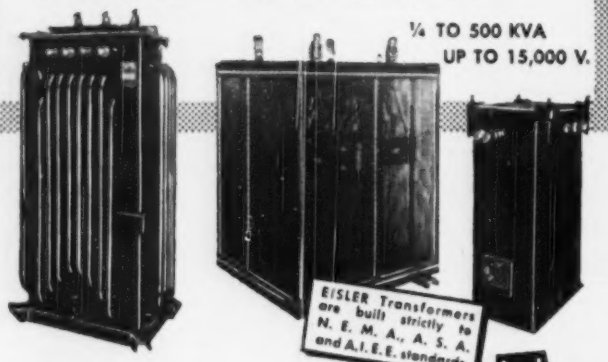
STANDARD • SPECIAL

AIR • OIL • WATER-COOLED

for

POWER DISTRIBUTION • LIGHTING • AUTO • ELECTRIC FURNACE • HEATING • PHASE CHANGING • WELDING • GENERAL PURPOSE

¼ TO 500 KVA
UP TO 15,000 V.

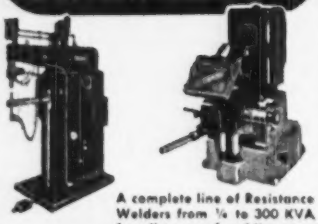


In addition to the manufacture of standard transformers the Eisler organization is especially well adapted to design and build transformers to the customer's specifications when departure from standard construction is desired. Send in your specification for quotations.

SEND FOR NEW CATALOG TR-50

EISLER RESISTANCE WELDERS

SPOT • BUTT • GUN • SEAM



A complete line of Resistance Welders from ⅛ to 300 KVA for all types of welding.

CHAS. EISLER, Pres.

EISLER ENGINEERING CO. INC.

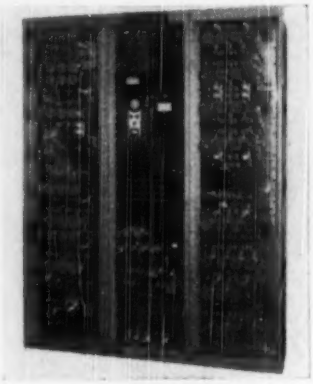
769 SOUTH 13th ST. NEWARK 3, N. J., U. S. A.

bodies have been designed for use with the company's Model LD four-wheel drive chassis.

Basic construction body is a platform body built of 12-gage safety tread steel plate. It is 90 in. wide with a standard 10-ft length. The body is provided with winch openings and derrick mounting brackets. Locker compartments may be mounted on either side of the platform body, either above or below it. A wide variety of bins and separators may be specified for the lockers.

Model U9 maintenance body (illustrated) is 9 ft long by 90 in. wide. The three-section, all-steel top protects body load and telescopes to provide space for winch and derrick operation.

The Four Wheel Drive Auto Co, Clintonville, Wis.



Multiplex Terminals

COMMUNICATIONS channelizing of the time-division type (series CMT-4) for use with microwave radio relay systems employs pulse amplitude modulation (P.A.M.). Multiplex terminals are available to provide 4, 8, 12, 16, 24 or 32 voice channels, and for relay, telemetering, and supervisory control applications.

These multiplex terminals are said to

MORE NEW EQUIPMENT

Just Received

Appearing Next Issue

AIR-BREAK SWITCH MECHANISM
Gas-operated mechanism adaptable to sectionalizing, etc

ANNUNCIATOR
Surface or flush mounted, designed for readability at 60 ft

POLE-SETTING DERRICK
Adjustable boom permits derrick to handle poles 35 ft long

PHASE CONVERTER
Three-phase 220-v motors to 7½ hp can be used on 1-ph lines

NOW with New Safety Hook!

BLACKBURN Jiffy Lift HOIST & PULLER

EXCLUSIVE FEATURES:

LIGHTEST!

Complete hoist weighs less than 12 lbs., yet has ¾ ton capacity, with large factor of safety.

SIMPLEST!

The only puller-hoist made with a single control for UP and DOWN and Automatic Free-Wheeling. Universal operation—handle operates on either side for lift or pull.

FASTEST!

Quick action, Ratchet-type. Easy to rig—quick to use. Operator can also vary lift per stroke. High efficiency means less fatigue.

JIFFY LIFT IS IDEAL FOR:

Tightening Guy Wires... Pulling Cables and Messenger Wires... Skidding or Lifting Heavy Equipment... Installing and Repairing Machinery... Pulling Motors, Wheels, etc.... Lifting in Close Quarters ... General Maintenance... In short, for any Lift or Pull.

Safety hook is optional at a small additional cost

ORDER FROM YOUR JOBBER — MONEY-BACK GUARANTEE

Mail Coupon Now for Illustrated Folder

JASPER BLACKBURN PRODUCTS CORP.
FIRST, MADISON & CLINTON STS. • ST. LOUIS 6, MO.

Send me, without obligation, Illustrated Circular describing the Blackburn Jiffy Lift Hoist & Puller, prices on same, and name of nearest jobber.

Your Name & Title _____

Firm Name _____

Address _____

have both the freedom from crosstalk of time-division systems, and the spectrum economy of commercial telephone carrier systems. Composite output of a 32-channel terminal is less than 300 kc wide. A feature of the PAM system is the ability to drop out one or more channels at repeater stations.

Philco Corp, Tioga & C St, Philadelphia 34, Pa.

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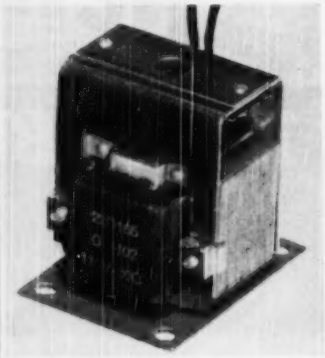

Industrial Solenoid

CAST-PERMAFIL coil assembly is the feature of a short-stroke solenoid for heavy-duty industrial applications. In comparative life tests the solenoid operated millions of times before failure, it was said. It is available in four models, including strokes of $\frac{1}{8}$ and $\frac{3}{8}$ in. and two stacking thicknesses.

Basic component is a paper-layer-wound coil, a type that is reported to hold the voltage between turns to a minimum. A "T" magnet is used, and a large dual-pole shader is said to give quiet operation. Coil can be changed readily by removing two bolts that permit the backstop and plunger to slip off, releasing the coil.

General Electric Co, Apparatus Dept, Schenectady 5, N. Y.

•

CO_2 Extinguishing System

A NEW carbon dioxide fire extinguishing system has been designed for Class B and C risks requiring localized protection, or for risks where total flooding with CO_2 gas is essential. Manufacturer reports that it is especially designed for fire protection of rotating electrical equipment where a sustained discharge of CO_2 is necessary.

One of its prime advantages is said to be its flexibility of installation. Its battery and operating mechanism can be conveniently located at, adjacent to, or remote from a risk, as desired. Operation is furnished from a solenoid type mechanism, the cylinders being fixed in an upright position. Extra cylinders

Don't Shell Out for Shell Rot!

Use **penta-protected** POLES
chlorophenol

PENTAchlorophenol is your answer to costly shell rot! Because PENTA is a *clean* wood preservative, full length protection of *all* poles is now possible.

PENTA-treatment helps stop costly shaving or premature pole removals due to shell rot, by giving effective protection against decay and termites. The low solubility and volatility of PENTAchlorophenol make it last for years.

Find out how PENTA can cut your pole maintenance costs. Write directly to Dow, Dept. PE-21B.

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

THE CLEAN WOOD PRESERVATIVE

DOW
penta-
chlorophenol

they'll tell you that... although most tapes look alike, there is a big difference — in quality and in workability. Men who work with tape know from experience that Accurate Tapes have the proper tackiness for fast, easy application, that it wraps tight and stays tight, will not ravel and tears off clean.

As for performance qualities, Accurate Tapes have high dielectric and tensile strength, superior aging qualities and are backed by 30 years of specialized experience in tape manufacture. It's important to note, too, that every foot of Accurate Specification Tape exceeds ASTM standards by a wide margin. Specify Accurate on your next tape order — it's the sure way to guarantee quality.

WAREHOUSE STOCKS and representatives strategically located for prompt, efficient service from coast to coast. Write for name of representative nearest you and illustrated catalog — just address ACCURATE MANUFACTURING COMPANY, GARFIELD, NEW JERSEY.

ACCURATE ASTM FRICTION TAPE exceeds all requirements of ASTM designation: D69-48T.

ACCURATE ASTM RUBBER TAPE exceeds all requirements of ASTM designation: D119-48T.

IT'S TAPE IF WRITTEN THIS WAY

ACCURATE TAPE

can be installed readily, and no extra parts are required for recharging.

In event of fire, an automatic warning sounds, motors are de-energized, and doors and windows are closed.

American-LaFrance-Foamite Corp, Elmira, N. Y.

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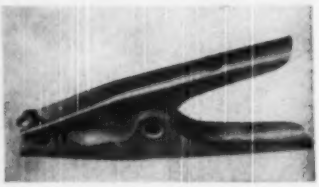


GROUND CLAMP—Three hundred amp is the capacity of the GC-3 ground clamp for welding jobs where welding currents do not average above that capacity. Jaws are made from a steel and copper alloy, Lincalloy, and have a spread of 2½ in.

The Lincoln Electric Co, Cleveland 1, Ohio

•

Silver Plating Units

SILVER PLATING electrical contacts on the job can be performed with types WR and WL Silver Platers. The WR silver plater, with rounded electrode, is designed for use in coating flat surfaces such as bus bars, relays, or circuit breakers. Type WL, with long narrow electrode, is intended for coating fuse clips, switch jaws, bus supports and clamps, etc. These units weigh only 3 lb and so may be used on pole tops, for high substation work, between buses in manholes, and for generating and substation maintenance. More information appears in Bulletin No. 101.

J. A. Weaver Co, 2110 Howard St, St. Louis, Mo.

•

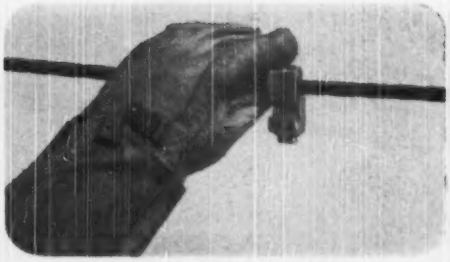
AC Motor

ALTHOUGH fundamentally an induction motor with a standard squirrel cage rotor, the stator of a new ac motor employs, in addition to its running winding, a 1-ph ac winding for electrody-

Simple as 1-2-3 to Install...

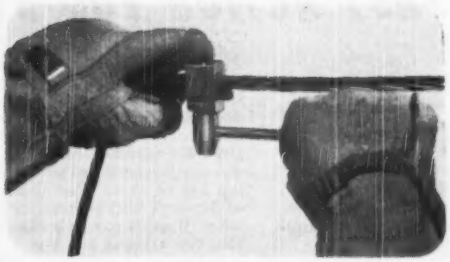
FARGO CONNECTORS Hold Wires Permanently!

"...built like a vise ---grips like a vise"



1st: HOOK ON RUN

2nd: INSERT TAP



3rd: TIGHTEN BOLT

FARGO

AVAILABLE IN ALL TYPES

Fargo vise-type connectors are available in lap, straight and diagonal jaw designs. Plated spacer bar types are recommended for dissimilar metal connections. There are also heavy-duty, two-bolt spacer bar types, with "one-piece" features, for transmission and heavy primary applications.

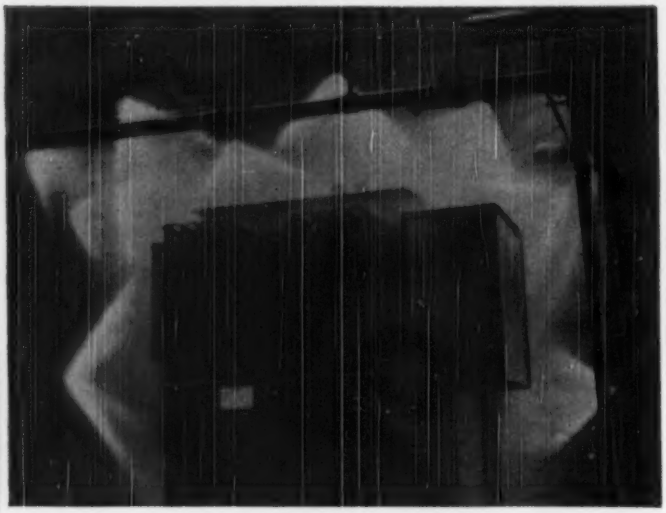
*Approved by Underwriters' Laboratories, Inc.

Manufactured by
FARGO ASTC COMPANY INC
Pawtucket, R.I.

Distributed by
LINE MATERIAL COMPANY
Milwaukee, Wisconsin

LM

Protect DANGER ZONES!



with BLAW-KNOX FAST ACTION FOG SYSTEMS

Deluge Systems, Wet Pipe Systems, Dry Pipe Systems, Water Spray and Fog Systems, Rate-of-Rise Sprinkler Systems, and Foam and Carbon Dioxide Extinguisher Systems.

Protecting transformers and equipment adjacent to any danger spot is just as important as prompt extinguishing of the actual fire. Wherever fire breaks out in any transformer . . . indoors or out . . . the Blaw-Knox rate-of-rise thermostatic system sounds the alarm and starts a dense, quenching fog of water. The undamaged portion of the bank will be back in service quickly when Blaw-Knox Fog Nozzles are on the job. No screens to clog . . . treated water unnecessary . . . effective maintenance of spray pattern even at reduced pressures.

"LITTLE JOEY SPRINKLER"

A Blaw-Knox Engineer will make a survey of your fire hazards, secure your insurance underwriter's requirements, prepare a preliminary layout of a system that will give you the utmost in fire protection, and submit an estimate of costs—all without obligation.

BLAW-KNOX SPRINKLER DIVISION
OF BLAW-KNOX CONSTRUCTION COMPANY
829 Hamer Ave., N.S., Pittsburgh 12, Pa.
Offices in Principal Cities

BLAW-KNOX FIRE PROTECTION SYSTEMS

namic braking. Under influence of the braking winding, a retarding force several times that of full load torque is reportedly applied to the rotor. As the motor approaches a complete stop, the braking force becomes negligible. This permits shifting of gears, turning by hand, or position-stopping. Available sizes are from 1/20 to 10 hp (NEMA size 286) single and polyphase motors.

Standard Dayton Corp, P. O. Box 1001, Dayton 1, Ohio

•

Canvas-Back Loomwire

TWO IMPROVEMENTS have been incorporated in the design of the manufacturer's canvas-back loomwire, a non-metallic sheathed cable.

The No. 14 and 12 cable, with Type T or Type R conductor insulation, now have a "frosty finish". This finish is said to allow the cable to be handled or stored in warm locations without becoming tacky, and improves ease of installing the cable. Stripping is reported to be improved due to insertion of a paper dam completely around the conductor assembly, under the sheath. This barrier adheres to the sheath when stripped and assures a clean conductor assembly.

National Electric Products Corp, Chamber of Commerce Bldg, Pittsburgh 19, Pa.

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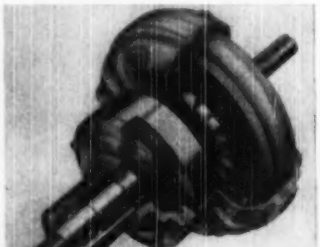
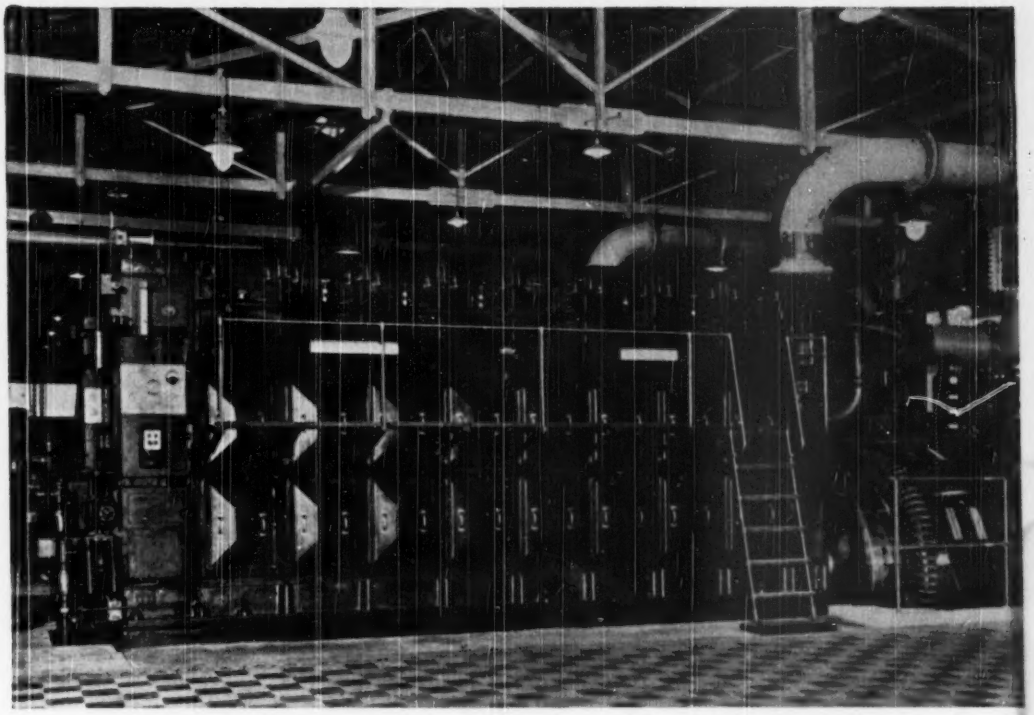


Winding Drive

MAINTAINING constant tension and lineal speed in winding operations, including wire winding, are claimed to be solved by the Hydro-Wyne. As the



It's 2 to 1 That Superior's Best

● In 1947 a private utility in Venezuela installed two Superior Diesels and another well-known diesel of the same rating. Since operations began the Superior Diesels have lived up to their name.

These two mighty engines have a combined capacity of 2880 horsepower and they produce up to 2000 kilowatts. In spite of peak overloads and great changes in the power distribution system, the Superior Diesels have performed efficiently and proved their dependability. Downtime for routine maintenance has been held to a minimum.

Economical operation is always of prime importance. And here is where the two Superior Diesels are outstanding. Both Superior Diesels run quieter and generate more KWH per gallon of fuel than the other diesel that operates in the same plant.

There are many similar cases where Superior Diesels have provided superior performance. And their owners have benefited where it counts most . . in low-cost power production. If you're looking for such economy, why not let us have a Superior representative call? Or, if you prefer, write for our fully illustrated booklet, *Superior Diesel For Stationary Application.*

THE NATIONAL SUPPLY COMPANY
SUPERIOR ENGINE DIVISION
Plant and General Sales Office: Springfield, Ohio

THE NATIONAL SUPPLY COMPANY NSCO

Superior DIESELS

Locomotive · Marine · Oil Field · Stationary

"We stopped both useless shutdowns and motor burnouts from Single Phasing by installing Fusetron fuses in a refrigeration compressor circuit"
Glenn F. Buschman, Manager
Kirby Risk Electric Motors, Inc.
Lafayette, Ind.

Mr. Buschman continues—

"In December '47 we rewound a motor for the Rund Packing Company of Lafayette, Indiana that had been burned out on single phase.

"One week later the same motor came back, again burned out on single phase.

"We investigated and found that the motor was used on the refrigeration compressor and that starting currents were causing the 100 amp. 250 volt renewable fuses protecting the circuit to blow. When one of them blew it single phased the motor.

"The thermals in the starter were oversize and so the motor burned up.

"100 amp. FUSETRON dual-element fuses were installed in place of the ordinary fuses and the thermals changed to the proper size.

"The thermals have so far never had to operate because the FUSETRON dual-element fuses stopped the useless blows on the starting current. This automatically stopped the single phasing that had previously caused the motor burnouts."

FUSETRON FUSES GIVE 10-POINT PROTECTION

TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION

BUSS

1. Protect against short-circuits.
2. Protect against needless blows caused by harmless overloads.
3. Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation.
4. Provide thermal protection — for panels and switches against damage from heating due to poor contact.
5. Protect motors against burnout from overloading.
6. Protect motors against burnout due to single phasing.
7. Give DOUBLE burnout protection to large motors — without extra cost.
8. Make protection of small motors simple and inexpensive.
9. Protect against waste of space and money — permit use of proper size switches and panels.
10. Protect coils, transformers and solenoids against burnout.

★ Fusetron fuses have high interrupting capacity. Tests conducted by the Electrical Testing Laboratories of New York City in December 1947 showed that on a 240 volt 60 cycle 3 phase, 4 wire circuit set to deliver 50,000 amperes, 30, 60, 100, 200, 400 and 600 ampere 250 volt Fusetron fuses on each and every test cleared the circuit without batching flame and with comparatively little noise.

FUSETRON is a trade mark of the Bussmann Mfg. Co., Division of McGraw Electric Co.

Fusetron DUAL-ELEMENT Fuses

Give All-Purpose Protection

because . . .

The fuse link element opens on short-circuit — the thermal cutout element protects on overloads — the result, a fuse with tremendous time-lag and much less electrical resistance.

They have the same degree of Underwriters' Laboratories approval for both motor-running and circuit protection as the most expensive devices made.

Made to the same dimensions as ordinary fuses — fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere, both 250 and 600 volt types. Also in plug types for 125 volt circuits.

Their cost is surprisingly low.

Don't Risk Losses

One needless shutdown
One lost motor
One destroyed switch or panel

may cost you far more than replacing every ordinary fuse with a FUSETRON dual-element fuse

MAIL THE COUPON NOW
for complete information about Fusetron Fuses and their 10-point all-purpose protection

Bussmann Mfg. Co., University at Jefferson St. Louis 7, Mo.
(Division McGraw Electric Co.)

Please send me complete facts about FUSETRON Dual-Element FUSES.

Name .....

Title .....

Company .....

Address .....

City & Zone ..... State .....

850

FIRST CHOICE
for

- **PERMANENCE**
- **HOLDING POWER**
- **LONG LIFE**
- **SAFETY**

They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all others. Available two-way, three-way, four-way and cone types. Write for facts.

Exclusive Everstick nut housing. Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO.
Manufacturer of
"THE ANCHOR OF MERIT"
FAIRFIELD, IOWA

torque load increases or decreases, the new drive causes output torque—rather than horsepower—to change proportionately. When pre-determined speeds and tensions have been set, no further adjustments are said to be necessary.

Twin Disc Clutch Co, Racine, Wis.

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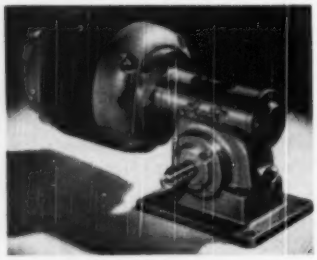


Gearmotor

RIGHT ANGLE type gearmotors, single and 3-ph models, are available in parallel-output and right-angle vertical-output units. Ratings are from $\frac{1}{6}$ to 5 hp; ratios 5.8:1 to 100:1; output speeds from 17.5 to 302 rpm. Enclosures are drip-proof, totally enclosed, or fan-cooled. Additional information is in Bulletin B250.

Abart Gear & Machine Co, 4828-36 W. 16th St, Chicago 50, Ill.

MORE NEW PRODUCTS
about which you should know

INDUSTRIAL ELECTRICAL WORKS, OMAHA, NEB., offers a **collector ring** for slow-speed operation to carry current up to 75 amp at 220 v; has 1, 2, 3, or 4 conductors. . . . GLASS FIBERS, INC, WATERVILLE, OHIO, is producing Vitron **glass yarns** for weaving, serving, braiding or reinforcing applications; being used in insulating magnet wire.

MODERN LIGHT & EQUIPMENT CO, 3812 S. WABASH AVE, CHICAGO 5, ILL., has a new series of streamlined fluorescent **fixtures** intended for schools, stores, and offices. . . . WATERMAN PRODUCTS, INC, PHILADELPHIA 25, PA., has introduced Model S-14-B Wide Band Pocketscope, a portable laboratory **oscilloscope.** Its linearized triggered or repetitive time base is continuously variable from 0.5 cps to 50 kc, with either ± polarity of sync or trigger.

COLE INSTRUMENT CO, 1320 S. GRAND AVE, LOS ANGELES 15, CAL., offers **electrostatic voltmeters** for measuring static voltages, and checking the charge of condensers, potential of cathode ray tubes, etc. Scale from 120 to 12,000 v. . . . KELITE PRODUCTS, INC, BOX 2917 TERMINAL ANNEX, LOS ANGELES 54, CAL., has developed Poly-Kote for **treating iron** and steel preparatory to painting. It eliminates need for treating with chromic acid.

A. E. TOMPKIN & CO, 1828 COLUMBIA RD, N.W., WASHINGTON 9, D. C., is making the Hydrion Canister Demineralizer which is said to convert ordinary tap water to pure **battery water;** electronic indicator shows purity of the delivered water. . . . MAGNI-LITE, INC, 60 E. 42ND ST, NEW YORK 17, N. Y., has a line of all-weather, **sealed beam floodlights** and spotlights, 360-deg utility, applicable to street lighting, outdoor signs, gas stations, etc.

THE HART MFG CO, 110 BARTHOLOMEW AVE, HARTFORD, CONN., has made improvements in its line of electrical **controls** and devices including wider face areas and flanges, and re-engineered toggle switches. . . . BROWN INSTRUMENTS DIV, WAYNE & ROBERTS AVE, PHILADELPHIA 44, PA., is producing a laboratory-type electronic indicator for measuring **minute voltages;** can be used in checking, calibrating and standardizing meters, potentiometers, and thermocouples.

DICKSON ENGINEERING & SALES CO, 4701 TOWNES RD, MINNEAPOLIS 10, MINN., is offering the Vari Hot **soldering iron** which is reported to heat in 30 sec, and idle at 500 F. . . . WELDING ALLOYS CO, INC, 273 FERRIS AVE, WHITE PLAINS, N. Y., has announced a cutting **electrode** said to cut, pierce, gouge, chamfer, or remove welds without using oxygen or special equipment.

SYLVANIA ELECTRIC PRODUCTS, 60 BOSTON ST, SALEM, MASS., has announced four new fluorescent lighting **fixtures** for high ceiling commercial areas (4 and 8-ft slimlines). . . . INDUSTRIAL STARTER CORP, 6 PELL ST, NEW YORK 13, N. Y., is making Type TC fluorescent **lamp starters** which perform all operations with bimetals, resistor and auxiliary circuits in air. Tube is reportedly started in one cycle.

THE RICHARDSON-ALLEN CORP, 15 W. 20TH ST, NEW YORK, N. Y., has developed a regulated **power supply,** 24 to 32 v dc, for use on productioin lines, testing of radio communication equipment in airplanes, etc. . . . ROCHESTER RIBBON AND CARBON CO, 100 ANDERSON AVE, ROCHESTER, N. Y., has introduced Labelon, a smudge-proof **labeling tape,** that is said to be water and oil proof, acid resistant, withstands temperatures to 150 F.

FOR P·G·and E·

The Kern Steam Plant and the extension to Station P of the Pacific Gas and Electric Company represent the finest examples in the country of centralized control in steam power stations.

The Kern Steam Plant, with an installed rated capacity of 175,000 kw, recently completed for the Pacific Gas and Electric Company in Kern County, about 300 miles south of San Francisco in the San Joaquin Valley.

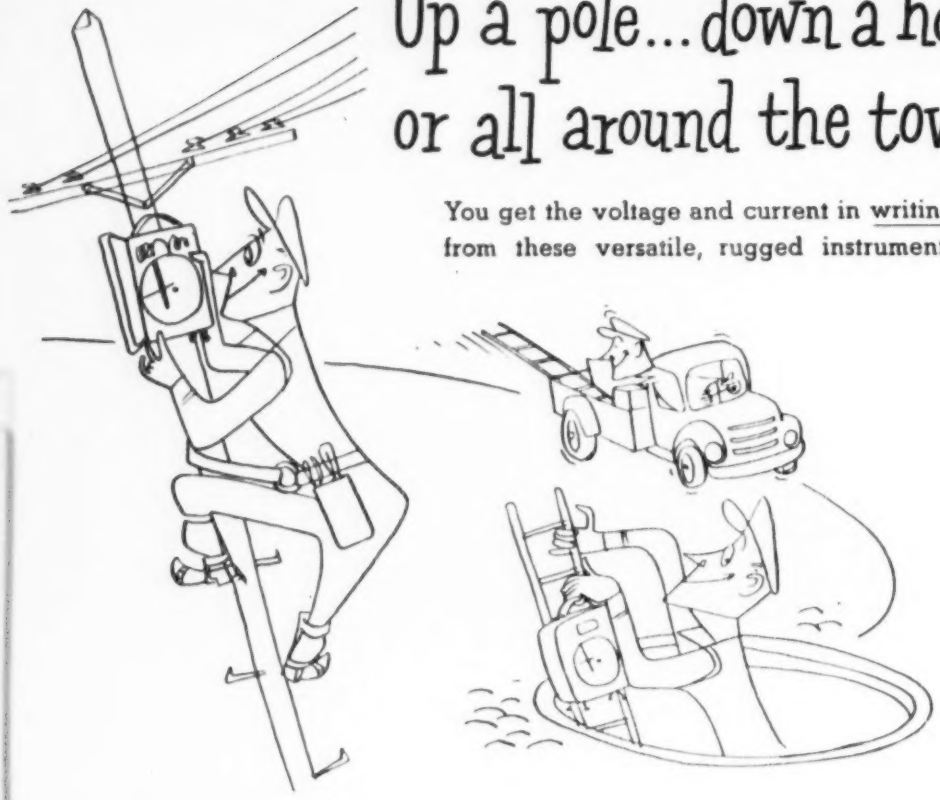
The extension to Station P, with an installed rated capacity of 222,000 kw, designed and constructed by Stone & Webster Engineering Corporation for the Pacific Gas and Electric Company at Hunters Point, San Francisco.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.

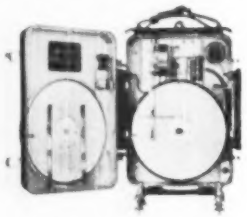
Up a pole... down a hole or all around the town

You get the voltage and current in writing from these versatile, rugged instruments



Bristol All-Purpose Recording Voltmeters and Ammeters

Lightweight and self-contained . . . all parts built for rough handling



For the most efficient operation of your electrical system, keep an eye on voltage and current.

Knowing the facts — accurate, complete, clear—you can make the necessary corrections.

Bristol's All-Purpose Recorders —with weather-proof case and light weight—handle a great variety of work . . . pole-mounted, wall-mounted (ideal for damp cellars and manholes), permanently mounted—or portable. 1, 2 or 3 pen types.

In stock for immediate delivery.

Write for Bulletin E1100. THE BRISTOL COMPANY, 116 Bristol Rd., Waterbury 20, Conn.

BRISTOL

Gives You the FACTS

When and Where You Want Them

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

NEWS ABOUT PEOPLE

Georgia Power Elects Boozer Vice President

Herman W. Boozer, comptroller of Georgia Power Co, has been elected a vice president.

After working several years as a certified public accountant with New York and Atlanta accounting firms, Boozer became assistant general auditor of Alabama Power Co in 1925. Later he was made general auditor.

In 1937 he returned to Atlanta as

HERMAN W. BOOZER

general auditor of Georgia Power. He was elected to the board of directors in 1940 and was designated comptroller in 1944.

Boozer is a past chairman of the accounting section of the Southeastern Electric Exchange, vice president and a director of the Controllers Institute of America, and a past president of the Atlanta chapter of the National Association of Cost Accountants.

•

V. K. Babcock, director of budget control of Central Arizona Light & Power Co, has been made manager of the company's new industrial development department. The first company man assigned to work exclusively on industrial development, he will have the job of attracting new industry to Arizona, creating new industry within the state, and aiding existing industries to expand their production and marketing facilities.

Prof Walter Curtis Johnson has been appointed chairman of the department of electrical engineering at Princeton University to relieve **Prof Clodius Harris Willis,** who will continue in the department. For several years Johnson has been engaged in research work on magnetic amplifiers. He went to Princeton from General Electric Co.

•

New England Electric Names New Appointees

Several personnel shifts have been made in New England Electric System.

H. R. Selfridge, assistant to the central division superintendent of New England Power Co at Worcester, Mass., has been named an operating assistant for the power company. His headquarters will be in Boston.

B. G. Larson, technical assistant in the western division of New England Power since 1942, has been transferred to Worcester in that capacity. Daniel T. Chane, Jr. has been appointed an executive assistant of the Mystic Valley and North Shore districts of NEES.

Selfridge started with GE in 1927 and went to the power company at Worcester as technical assistant in 1929. Larson joined the system in 1935 and for a time was an operator at Millbury. Later he went into meter work at Shelburne Falls. Chane was with Stone & Webster in New York and Jackson & Moreland in Boston before engaging in rate work for New England Power Service Co.

•

John J. Tuohy, attorney on the legal staff of Long Island Lighting Co, has been elected assistant to the president. Named assistant vice presidents were **Louis A. Evarts,** gas operating manager; **Edward C. Duffy,** electric operating manager; **William Welch, Jr,** engineering manager; **Howard B. Wakeman,** customer relations manager; **William J. Schmidt,** general sales manager; **William A. Miller, Jr,** personnel officer; **Charles Y. Osburn,** assistant to the operating vice president; 'and **Walter H. Seaman,** insurance manager of the company.

W. S. Welday has been named manager of an enlarged eastern division of Ohio Power Co. The eastern and Sunnyside divisions were merged, with Steubenville as headquarters and the Sunnyside offices at Bellaire as a district office. Assistant manager of the new division is **W. S. Judy.**

F-W Makes Foster Head of Equipment Company

Pell W. Foster, Jr, has been named vice president of Foster Wheeler Corp, New York, in charge of a newly created equipment division.

The new divison will be made up of the steam, industrial, marine, and condenser departments, existing commercial engineering groups serving the power generation, industrial processing, and marine industries. Purpose is co-

PELL W. FOSTER, JR

ordination of the present departments' activities with the manufacturing and sales group.

Foster has been a director and vice president in charge of production since 1946. He will continue as active head of the production and procurement departments.

•

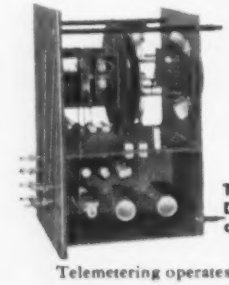
John R. Kelly has been appointed general superintendent of the Gainesville, Fla., city utilities. **Joe E. Cox** was named superintendent of electric and water distribution, **R. G. Crosby** superintendent of the new electric plant, and **Francis Gateman** general foreman of electric distribution.

Frederick C. Schlemmer, former manager of the Hanford Works of the Atomic Energy Commission at Richland, Wash., has been appointed manager of construction of Burns and Roe, Inc, New York engineers and constructors. From 1933 to 1946 Schlemmer was project manager in charge of construction of the Tennessee Valley Authority's Fontana, Watts Bar,

Control Corporation's
Supervisory Control
PLUS TELEMETERING...
COMPLETES THE DISPATCHER'S PICTURE

Flexible SUPER-TROL* Combined with Telemetering Is Custom-Engineered to Handle ALL Supervisory Control Problems

*SUPER-TROL Is Control Corporation's Modern Method of Supervisory Control



Telemetering added to SUPER-TROL enables the modern Dispatcher to keep instant and continuous finger tip control over all equipment of his system.

Telemetering operates over the same line used for SUPER-TROL . . . requires no extra circuits . . . can handle supervisory, telemetering and telephone operations simultaneously.

SUPER-TROL installations easily incorporate voltage, power, flow and pressure and water level telemetering. Recording meters supply continuous, accurate performance records . . . fast, money-saving Telemetering.

Write for Bulletins AA-2 and EA-2 which explain Control Corporation's Supervisory Control and Telemetering System. It's the modern method of *complete* supervisory control.

CONTROL CORPORATION
719 CENTRAL AVE. • MINNEAPOLIS 14, MINN.

Chickamauga, and Norris Dams and the 240,000-kw Watts Bar steam electric power plant. In 1946 as a member of an American technical mission to India he made a study for the development of the Damadar River.

•

New Assignments

C. A. Watson, assistant superintendent of the Cape Fear generating plant of Carolina Power & Light Co, has been made superintendent of the new 200,000-hp plant at Goldsboro, N. C. He has been with the company since 1925. . . . **Paul B. Hartmann** has been named Mount Vernon, Ind., manager for Southern Indiana Gas & Electric Co. . . . **Prof T. G. Baumeister** has been advanced to John Stevens professor of mechanical engineering at Columbia University. He is a consultant to American Gas & Electric Co on power plant design. . . **Mort Kimsey** has been named Scottsdale district manager of Central Arizona Light & Power Co. . . **R. H. Jones** has been appointed assistant to the General Electric Co Apparatus Department comptroller. He has been supervising auditor in the Auditing Division at Schenectady. . . **L. E. Noelck,** Western sales manager of C. P. Clare & Co, Chicago relay manufacturer, has been appointed assistant sales manager. . . **Ira G. Dietrick** has been appointed manager of the New England district of Westinghouse Electric Corp's Lamp Division, with headquarters in Boston. He succeeds **George H. McGilvray,** who has retired.

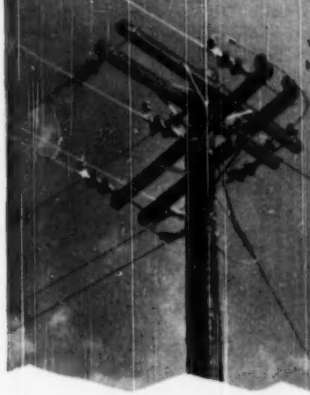
•

D. W. Nethercut and **Louis F. Ferri** have joined Commonwealth Services, Inc, Jackson, Mich. Both came from the central engineering department of Ohio Public Service Co. Nethercut, who has been system planning engineer, will hold a similar post with Commonwealth. He had been with OPS and its predecessors since 1919 and had served as distribution superintendent in Mansfield and Sandusky. He is a fellow of the American Institute of Electrical Engineers. Ferri spent 25 years with OPS, most recently with responsibility for electrical equipment design and the work of the testing laboratory.

William J. Millett, assistant to the vice president in charge of manufacturing of Worthington Pump & Machinery Corp, has been appointed manager of the Holyoke Works. He replaces **E. M. Detwiler,** who has resigned.

George J. Kuehnle, Jr, has been appointed manager of the northern division of Cincinnati Gas & Electric Co, with headquarters in Middletown. He succeeds **Arch Robinson,** who resigned

ANOTHER VICTOR INSULATOR THAT SAVES AS IT SERVES



VICTOR insulators and hardware on a 12 KV. line in Pennsylvania

ONE SOURCE: VICTOR

For distribution insulators and line hardware

YES, you can rely on VICTOR *alone* for *all* your distribution insulator and line hardware requirements . . . from pintype, spool, guy strain and dead-ending insulators, to strain and angle clamps of the highest quality. And, when you standardize on VICTOR, you—

CUT DISTRIBUTION COSTS 2 WAYS

1. *Less maintenance*—because these distribution insulators are ruggedly designed and made of the best "high voltage" porcelain to give you continuous, *trouble-free* performance under *all* kinds of operating conditions.

2. *Fewer replacements*—because each distribution insulator is thoroughly inspected and rigidly tested at *every* point of manufacture. This *guarantees* you top performance on-the-job.

So, on your next distribution job, standardize on VICTOR.

Now Available—

VICTOR'S ALL-NEW CONDENSED CATALOG

Write for your copy today!

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INSULATORS Inc.
VICTOR, NEW YORK

Look for this trade mark of enduring service

V

DRY-TYPE

Sub-Stations and Power Centers

for indoor installations

Engineered to meet **Your Exact Requirements**

Not necessary to design or change your installation to fit a "standard"

Any type of primary switch gear.

Metering—primary or secondary, to suit.

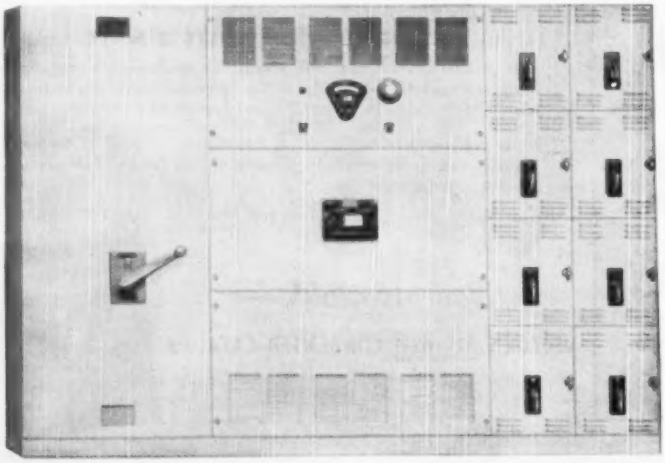
Secondary breakers, main, branch, or tie.

Interlocked or automatic throw-over. Draw-out or stationary types.
Magnetic trip, or thermal, or combination.
All incorporated with high quality, liberally designed

Sorgel Air-Cooled Transformers

All factory wired, tested and assembled. Mounted on a substantial steel base. Shipped as a single unit or in sections, accurately co-ordinated for easy assembly on the job. Sizes up to 2000 Kv-a. All voltages up to 15 KV.

Send for new bulletin 450



2000 Kv-a. 12,000 volt sub-station, with primary fused load interrupter switch, temperature indicator and alarm, and extra contacts that may be used to operate forced draft fans to increase capacity 25%

Sales Engineers in Principal Cities

SORGEL ELECTRIC CO., 834 W. National Ave., Milwaukee 4, Wis

Pioneers in the development and manufacturing of Air-Cooled transformers

to become city manager at Celina. Kuehnle went to Middletown in 1949 as the company's industrial development representative.

Richard W. Inman has been appointed vice president in charge of engineering for Associated Research, Inc, Chicago, maker of precision electrical measuring instruments. **Zenon J. Muchowicz** was named plant superintendent; **Joseph J. Peloso** production manager and purchasing agent; and **Robert G. Davis** assistant sales manager.

Charles A. Butcher has joined Worthington Pump & Machinery Corp as assistant to the president. He has been general manager of Crocker-Wheeler Manufacturing Co and vice-president of its successive parent companies, Joshua Hendy Corp and Elliott Co. Earlier he spent 18 years with Westinghouse Electric Corp.

Earl C. Dameron has been made assistant manager in charge of operation and maintenance of Duke Power Co properties at Durham, N. C. He has been electrical superintendent. **R. L. Lindsey**, long-time manager in Durham of Durham Public Service Co, Duke's predecessor, will continue with Duke in an advisory capacity. He has been with the company for more than 50 years.

Dr J. A. Hutcheson, director of research for Westinghouse Electric Corp, will be chairman of the Research and Development Board's committee on ordnance. Hutcheson has been a consultant to the committee for the past two years.

Mead W. Batchelor, until recently executive vice president of the Bridgeport Brass Co, has joined Chase Brass & Copper Co. He will be works manager of the two plants operated by Chase in Cleveland.

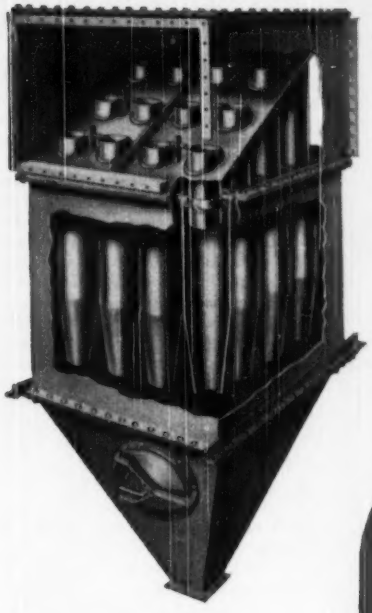
Fred D. Knight, vice president of Hartford (Conn.) Electric Light Co, has been awarded an honorary doctor of engineering degree by the University of Maine. He formerly was with Boston Edison Co.

Oliver W. Gatchell has resigned as chief engineer of the Horton Co, Lamar, Mo. He plans to open his own consulting office in the Midwest.

OBITUARY

John West

John West, 64, vice president of New England Electric System, Boston, died following a heart attack at Goshen,



In dust and fly ash recovery

MULTICLONE COLLECTORS

and only Multiclones give vital advantages like these...

No wonder "MULTICLONE" is the leading name in the centrifugal recovery of dust and fly ash from all types of gases, hot or cold.

No other mechanical recovery equipment has so many years of dust and fly ash recovery experience behind it . . . or has such uniformly high collecting efficiency . . . or provides so many other money-saving, space-saving advantages as MULTICLONE. The four advantages outlined below are by no means the complete MULTICLONE story, but are typical of the vital savings found *exclusively* in MULTICLONE equipment . . .

Uniformly High Recovery:

MULTICLONE's multiple *small diameter* tubes—made possible by its exclusive vane design—whirl the dirty gases with greater centrifugal force, thus throwing out not only the large, medium and small particles, but also a high percentage of the *extremely small* particles of 10 microns and less. This, coupled with the fact that there are no pads or filters to become choked with recovered material, results in a more complete recovery of *all* suspended materials from the gas stream.

Long and narrow

Square

Maximum Adaptability:

In addition to its unusual compactness, the MULTICLONE is also unusually adaptable to various installation requirements. Where head room is low it can be installed with side-inlet side-outlet connections. Where side clearances are restricted, it can be installed with side-inlet top-outlet connections. In addition, without changing capacities, the shape of the unit can be varied—long and narrow, short and wide, or square—to fit restricted spaces . . . and its single-inlet single-outlet duct requirements permit greater flexibility and simpler installation. These savings slice installation costs, space requirements and insulating expense.

Space-Saving Compactness:

Plant space costs money—so be sure to check space requirements carefully. As shown in the accompanying chart, the MULTICLONE requires less floor space and less cubic space than any other unit of comparable capacity and performance. Translate these savings into today's high costs for plant space and you readily see the great importance of this one MULTICLONE advantage alone!

Make	Relative Space Requirements In Sq. Ft.	In Cu. Ft.
Multiclone	1.0	1.0
Collector A	2.1	1.8
Collector B	5.9	3.2
Collector C	6.8	3.9

Minimum Maintenance:

The MULTICLONE has no high speed moving parts to repair or replace . . . no pads or filters to clean or renew . . . nothing to choke the gas flow or increase draft losses as suspended materials are recovered. MULTICLONE draft losses remain uniformly low *at all times*. Further, the recovered material from an entire bank of tubes is collected in a *single* hopper—far easier to service and maintain than the multiple hoppers of conventional cyclone units.

FREE INFORMATIVE BOOKLET

This 32 page booklet outlines the basic principles of centrifugal dust recovery and shows the *many* ways MULTICLONE advantages assure higher recovery at lower overall costs. A free copy of this booklet will gladly be sent on request. Write today!

Before you decide on any recovery equipment be sure to get complete information on MULTICLONE advantages. A letter, wire or phone call to our nearest office places this information in your hands without obligation. Get *all* the facts and you will get MULTICLONE Collectors!

WESTERN Precipitation CORPORATION

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Here the utility's Hydrocrane sets an electric pole in an alley. The yard supervisor states, "We find the Hydrocrane the safest rig we've ever used for setting poles and transformers in among wires. With that telescoping boom and the precision hydraulic control we can ease a pole or heavy transformer right into place. It's tops for maneuverability."

"this rig unloads poles twice as fast —safer too"

SAYS UTILITY MAINTENANCE MAN

"Our Bucyrus-Erie Hydrocrane unloads and stockpiles poles ranging from 30 to 65 ft. long — does the job twice as fast as we used to with hand methods," says the yard supervisor of a Midwest electric utility. "The Hydrocrane and three men can unload two cars of 30-ft. poles in a day — it took four men two days to do the same job by hand. We used to roll the poles off the cars, often causing breakage and making it dangerous for the men. Also stockpiling the poles by hand caused creosote burns on arms and hands. With the Hydrocrane all this is eliminated."

Hydrocrane Saves Time Here Too

Setting Poles
Unloading Transformers
Setting Transformers
Unloading Steel Beams and Wire
Handling Miscellaneous Supplies

Two Sizes — 2-ton ¼ yd.; 3-ton ⅜ yd.
Send the coupon for further information.

BUCYRUS-ERIE HYDROCRANE DIVISION
South Milwaukee, Wisconsin

BUCYRUS-ERIE HYDROCRANE DIVISION 71HD0
South Milwaukee, Wisconsin

Gentlemen: Tell me more about the Hydrocrane for utility work.

BUCYRUS ERIE HYDROCRANE

Name _____

Company _____

Address _____

City _____ State _____

Mass., Aug 2. He was on a trip to affiliated utilities in western Massachusetts.

At the time of his death West was in charge of the operations of all NEES retail companies in Massachusetts and New Hampshire except for Attleboro and Fall River, Mass. He had been with the system for nearly 40 years.

West entered the central station field in 1907 and long was a member of the consulting engineering firm of Macomber & West, Boston. His consulting activities included work in Europe and Central and South America as well as in the United States.

In his early career West was active in industrial power sales with the then Charles H. Tenney group of utilities in New England. Immediately before his election as a vice president of NEES, he was president of Worcester County Electric Co, Worcester, Mass., a subsidiary.

•

Nicholas Mikhailovich Oboukhoff, 77, research professor emeritus of electrical engineering and professor emeritus of mathematical physics at Oklahoma Agricultural and Mechanical College, died July 30 at Stillwater, Okla. A native of Russia, he was in charge of the Irkut River hydroelectric development project at Irkutsk in 1919 and 1920 and also had experience in locomotive building, irrigation, and flood control. He held patents in France, England, and the United States, chiefly on medium and high-frequency alternators, and was the author of a number of technical papers. Oboukhoff was a fellow of several scientific and technical societies, including the American Institute of Electrical Engineers, and a member of Eta Kappa Nu, honorary electrical engineering fraternity.

Joseph G. Wild, 71, a chemist who was responsible for a number of lighting improvements as head of the chemical laboratory at General Electric Co's National Lamp Works, died in Cleveland July 31.

Albert S. Goss, 61, manager of the industrial relations department of Georgia Power Co, died in Atlanta July 24. He joined the utility in 1920 and served as Augusta division superintendent of retail operations.

Roscoe C. O'Byrne, 57, Brookville, Ind, died there Aug 1. In 1949 he was chairman of the Indiana Public Service Commission.

Jens M. Jensen, 71, design engineer for General Electric Co, with which he was associated for 41 years, died July 30 in Lansdowne, Pa.

Cables run COOLER...
in TRANSITE DUCTS

. . . reducing copper losses

. . . increasing current capacity

. . . prolonging insulation life

HERE'S HOW to reduce copper losses . . . increase current carrying capacity . . . and prolong insulation life—run your cables in Transite* Ducts.

Current carrying capacities can be increased in a typical duct bank as much as 5%, or I^2R losses can be reduced 11%, for cables located in Transite as compared with other ducts used for power circuits.

And, Transite Ducts assure permanent duct banks because Transite is incombustible; is immune to rust and rot; is unaffected by electrolysis; will not slag under action of an arc, and will retain its high original strength.

An unusually smooth bore assures no injury to cable sheath, either in natural movement under load, or when pulling-in cables. Long, lightweight lengths can be quickly and economically installed. In addition, a full line of fittings simplifies even the most complicated of installations.

For full information on Transite Ducts, write for Data Book DS-410. Johns-Manville, Box 290, New York 16, N. Y.

*Reg. U. S. Pat. Off.

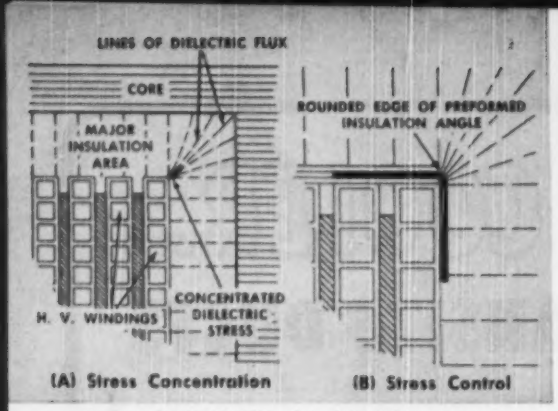
How Transite Ducts increase current carrying capacities

Type cable 3 cdr. 500 MCM Compack Sector, 15 KV (6th Edition AEIC Spec.)
No. of cables—3 (all loaded in one bank)
Daily Load Factor—75%
Earth Temp. ambient—20 C

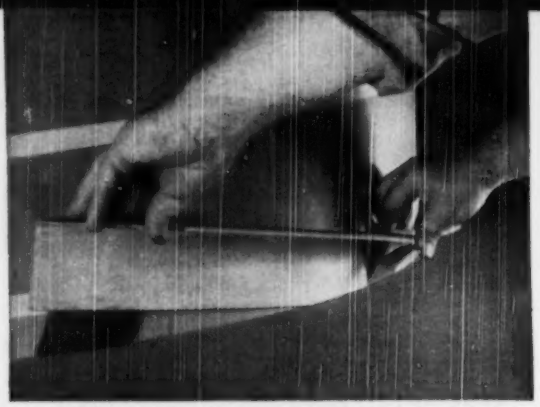
	Transite	Other
Total Therm. Res. to Dielectric Loss (C watts/ft.)	3.66	6.17
Total Therm. Res. to Copper Loss (C watts/ft.)	4.44	4.95
Temp. Rise from Dielectric Loss (C)	1.9	2.1
Allowable Rise for Copper Loss (C)	59.1	58.9
Allowable Watts per ft. cable	4.44	3.96
Allowable Current—(Amps. per cdr.)	386.	365.
Allowable Current—(Relative %)	105.6	100.

Johns-Manville *Transite Ducts* **"KORDUCT"— for encasement in concrete**

"CONDUIT"— for use exposed and underground without encasement



1 PRINCIPLE OF FITTING INSULATION right up next to areas of high dielectric stress, then reducing stress per unit area with rounded surfaces, is one of the methods used by Allis-Chalmers engineers to cut corona discharge.



2 PREFORMED INSULATION angles are fitted snugly against coils. This eliminates voids in critical regions and reduces concentration of dielectric forces to prevent corona formation. Die-forming of these angles on electronic heater insures exact fit, eliminates air pockets in insulation.

CORONA WON'T STEAL LIFE FROM THESE TRANSFORMERS

Transformers at Central Illinois Public Service Company Tell Story of Surge-Protected Insulation

WHAT MAKES a transformer grow old? One of the chief causes is internal corona discharge — an invisible hazard that can only be detected by accurate readings of cathode ray oscillograms. The presence of corona during operating surges *scores* insulation and causes gradual weakening of transformer impulse strength.

The complete solution to this problem is announced in the Allis-Chalmers corona-free design. By a combination of improvements, *all measurable effects of corona have been eliminated* — including effects that were not even detectable until recent years!

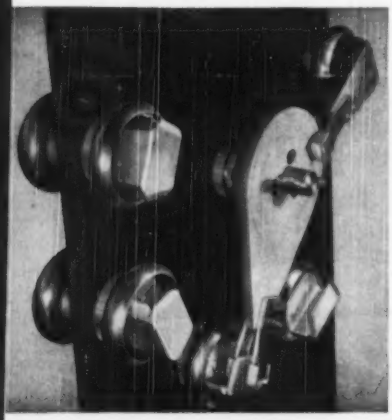
Insulation was moved right next to high voltage conductors, replacing "free space" with corona-resisting material in critical areas. Vulnerable parts of terminal boards were rounded and shielded to eliminate sharp contours. Dielectric fields were redirected, spacers redesigned and new materials used to completely "knock out" injurious corona.

Protected by this design, Allis-Chalmers power transformers will retain their full impulse strength after repeated surges or switching.

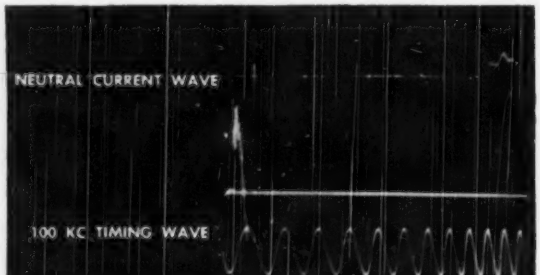
To the nation's electric power producers — like Central Illinois Public Service Company, purchaser of the transformer pictured here — this design will mean greater operating confidence, more reliable service, and full return on invested capital.

A-3092

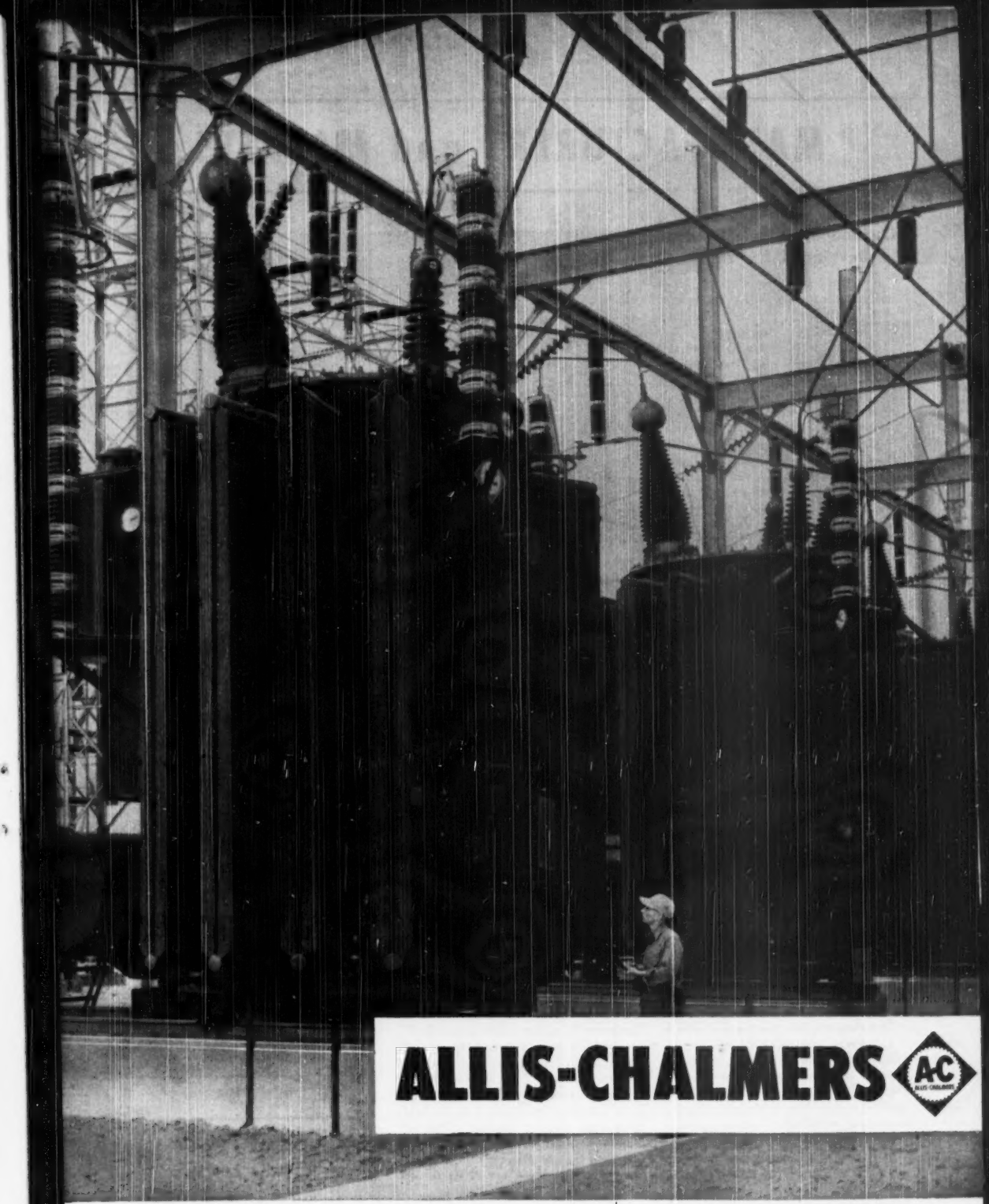
ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.



3 ROUNDED SHIELDS distribute electrostatic flux around tap changer contacts to stop corona. Spacers between contacts and panel control dielectric stress between contacts, permit more compact assembly.



4 EVEN THE SMALLEST corona effect—smaller than that which could harm transformers in years of operation — can be detected with new oscillographic test techniques. Above is sample oscillogram taken during a transformer impulse test. Analysis of many such curves, taken under varying conditions, showed "no detectable corona discharge whatsoever" at over five times normal operating voltage.



ALLIS-CHALMERS

5 TO FURTHER PROTECT against surges, high and low voltage lightning arresters are mounted directly on transformers, close to the bushings. *Oil-Sealed* Inert Gas expansion tanks are mounted on side of transformers, near the ground, to increase overhead line clearances. Installed bank is rated 35,000/45,000 kva, 138 to 69 kv; equipped with ± 10% load ratio control

MANUFACTURERS and MARKETS

Outdoor Splashproof Motor Developed by Elliott Co

A vertical splashproof motor for installation out of doors without external protective covering has been developed by the Elliott Co, Jeannette, Pa.

A line of horizontal and new vertical motors for this purpose has been laid out. They are available in 150 to 2,000 hp, 14 to 4 pole and 300 to 1,000 hp, 2 pole—440 to 4,160 v.

The new design, developed over a five-year period in cooperation with various consulting engineering firms and utility customers, is described as "radically different" from the conventional splashproof motor. It is intended to protect electric drive for out-of-door powerplant auxiliaries, pumps, fans, etc., against entrance of water or moisture into windings or bearings without the cost and complexity of totally enclosed, fan-cooled models.

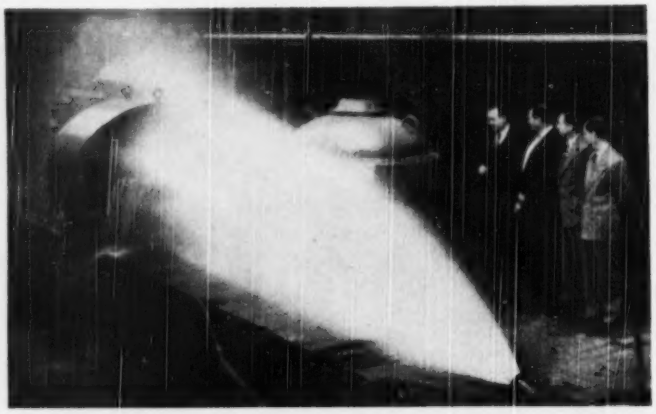
Initial installations have been in the southern half of the United States. Outdoor installations are now under construction as far north as Montana.

A recent outdoor witness test at the Ridgway, Pa., plant, where the motors are being built, showed no moisture penetration into internal windings, conduit boxes, or bearing seals. Insulation resistance remained constant. Dust that had accumulated after manufacture was found on the windings after the test.

Two Types Tested

A vertical 700-hp, 514-rpm, 2300-v motor was tested as well as a horizontal 500-hp, 720-rpm, 2300-v motor. A booster pump was applied to the plant water system to give 150-lb pressure, and special adjustable nozzles provided flows from a heavy jet to a soaking mist. Water from the hoses was directed into air inlets and outlets from all angles suggested by the witnesses. The test was continued for several hours.

In a shop test four nozzles adjusted to a fine spray were directed at the running motors from every angle, including directly into air inlets and outlets, 24 hours a day for four days. The test was applied to a horizontal sleeve-bearing, a horizontal anti-friction bearing, and a vertical anti-friction bearing motor. Windings were meggered every hour during tests; readings remained constant. When dismantled each motor was found to be completely dry inside.



SPRAY is directed at Elliott Co's horizontal splashproof motor during a test. At left is splashproof conduit box. Witnessing test are (l to r) H. L. Lowe, Ebasco; Charles Kiel, Long Island Lighting Co; Quentin Graham, Elliott Co; and Warren Compton, Ebasco

Producers Allocating Tight Supplies of Metals but Holding Prices Down

Still waiting for word from Washington about its plans for controls, producers of most nonferrous metals and steel last week had set up their own system of voluntary allocations.

Supplies are tight and expected to get even tighter when military spending swings into full gear. For the most part, however, the price line is being held. Only tin, up more than 20¢ a lb since mid-June, has shown any significant rise since outbreak of fighting in Korea.

A big squeeze is expected to come in aluminum. Military demands, especially for aircraft is likely to be heavy. In 1944 it took more than 85% of the primary aluminum produced.

Even before the war began capacity operation of primary production facilities had not been able to keep up with demand. The domestic industry has been importing about 25% of its requirements of primary aluminum, mainly from Canada. The big three in the field, Aluminum Co of America, Reynolds Metals Co, and Kaiser Aluminum & Chemical Co, are allocating production. Some new customers are being turned down.

National Security Resources Board is talking to producers about reactivating some of the idle capacity, estimated at 400 million lb, that has been lying idle since the end of World War II. Kaiser said it was buying equipment of a wartime government plant at Riverbank, Calif. (EW, Aug 7, p 21). The State Department has offered to sell American producers a dismantled German plant with an estimated annual capacity of 18,000 metric tons.

Scare buying is aggravating an already tight supply situation in copper, lead, and zinc. About 30% of normal zinc supply already goes to the government for stockpiling. Base prices for all three metals have changed little in the last month and a half, but some fringe prices have gone up.

Copper ore already was scarce before

Metal Prices
Aug 7, 1950

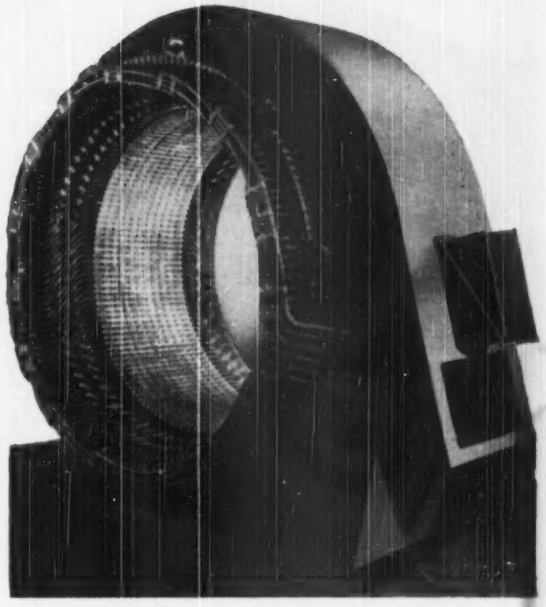
COPPER, Conn. V., lb	$ .22½
LEAD, N. Y., lb	.12
ZINC, prime Western, E. St. Louis, lb	.15
TIN, Straits qual, N. Y., lb	.98½
ALUMINUM, base price	.17½
NICKEL, base price	.48
STEEL billets, Pitts., ton	53.00
STEEL scrap, No. 1 heavy, Pitts., ton	41.00

Fact File on K&M ASBESTOS TEXTILES

K&M Woven Asbestos Tape used for outer protective covering for coil insulation in the stator illustrated possesses the following superior advantages: maximum flexibility and conformance, excellent flexural strength, and high abrasion resistance; results in easier, quicker installation. Greater absorption of impregnating compound results in a better seal and corresponding greater resistance to moisture, prolonging the life of the generator.

Each K&M Asbestos Textile is made to meet—and, in many cases, *surpass*—A.S.T.M. Standards. Each type of textile is made with the same careful workmanship, under the same strict laboratory control, that has helped K&M maintain its leadership in the field of asbestos textiles for more than 50 years.

Whatever your textile insulation problem, it will pay you to investigate K&M Asbestos Textiles. Write, specifying your needs.



• Stator of Allis-Chalmers 2000 KW, 6600 Volt, 3-Phase Generator. K&M Asbestos Woven Tape is used for the outer protective covering of the coil insulation.

STANDARD K&M ASBESTOS TEXTILES FOR THE ELECTRICAL INDUSTRY

WOVEN ASBESTOS TAPES: Fireproof, flexible; specially designed for insulating wires, coils, and cables. Made in both ferrous and non-ferrous types.

BRAIDED ASBESTOS TUBING: Made of asbestos yarn, braided into flexible tubing of various sizes. Used to cover wires to protect them against heat or chemicals; as insulation for coil terminals and transformer leads.

TWISTED ASBESTOS CORD: Used for tying cords in motors; for wire wipers; and for many other applications where strength is required under high operating temperatures. Made in a variety of types: Standard untreated cord of high tensile strength; wire inserted; and sized and waxed cords.

ASBESTOS YARN: Used for braiding or wrapping insulation over wires and cables; as a core for resistance wire. Made in all A.S.T.M. grades.

ASBESTOS THREAD: Manufactured by treating asbestos yarns with special compounds to produce a fine, dense, strong thread with a very smooth surface. Used for tying-in insulated heater cords, wrapping fine electrical instruments and for many other varied manufacturing processes where high temperatures are present.

We'll gladly send complete information on any K & M Asbestos Textile products upon request.

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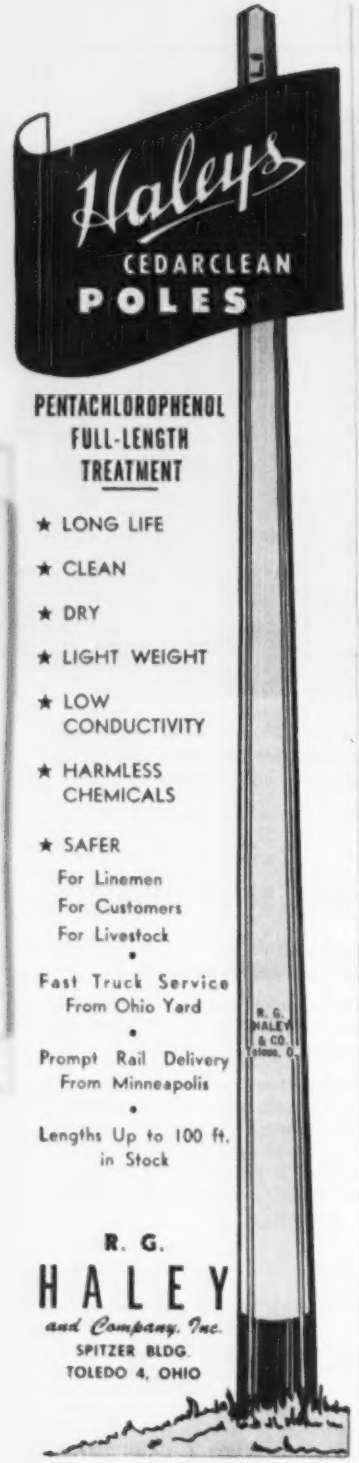

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the Korean war began. Congressional committee action on a bill to suspend again the 2¢-a-lb import duty on copper was expected last week.

Defense requirements, stockpiling, and present industrial demand indicate a monthly deficit of some 42,000 tons of copper and more than 6,000 tons of zinc. Despite premiums on scrap copper and resale zinc, demand is well ahead of supply.

Demand for lead was normal until a few weeks ago but has been climbing.

Tin has skyrocketed in price since the beginning of the war from 77¢ a lb for Strait quality in New York to 98½¢ Aug 7. Ore, not production capacity, is the problem. Traders apparently have been buying in fear that the Asiatic conflicts will cut off supplies from Malaya, the major producing area.

Steel plants were operating at 101% of rated capacity last week, with still higher production predicted for fall. Steel makers said they did not expect armament programs to affect their shipment patterns for many months. Voluntary allocations were expected to take care of all requirements now planned.

SALES ASSIGNMENTS

COMPANY STAFFS

General Electric Co has named Robert E. Pfeif manager of the Worcester, Mass., office of the Apparatus Department. He succeeds Henry O. Tilton, who has retired after 43 years.

Allis-Chalmers Manufacturing Co, Milwaukee, has made Mert M. York manager of the Boston district office. He has been in the Charlotte, N. C., office.

Westinghouse Electric Corp, Lamp Division, has appointed Ira G. Deitrick to succeed George H. MacGilvray as manager of the New England district. MacGilvray has retired after 36 years of service. Deitrick has been assistant district manager.

Bridgeport Brass Co, Bridgeport, Conn., has made several appointments. Irving M. Malsch succeeds Carl P. Quanz as Chicago district sales manager. Quanz has been made plant manager in charge of all activities at the Indianapolis Mills. David L. Nesler, of the Chicago office, will replace Malsch as Indianapolis district sales manager.

REPRESENTATIVES

W. N. Matthews Corp, St Louis, has appointed Stockwell Transformer Corp, 569 South Main St, Akron 11, sales representative in northern Ohio.

Pennsylvania Transformer Co, Canonsburg, Pa., has appointed Philips Export Corp, 100 E. 42nd St, New York, N. Y., as export sales representative.

T. J. Cope, Inc, Philadelphia, has appointed E. H. Gilliam Co, Charlotte, N. C., representative in North and South Carolina.

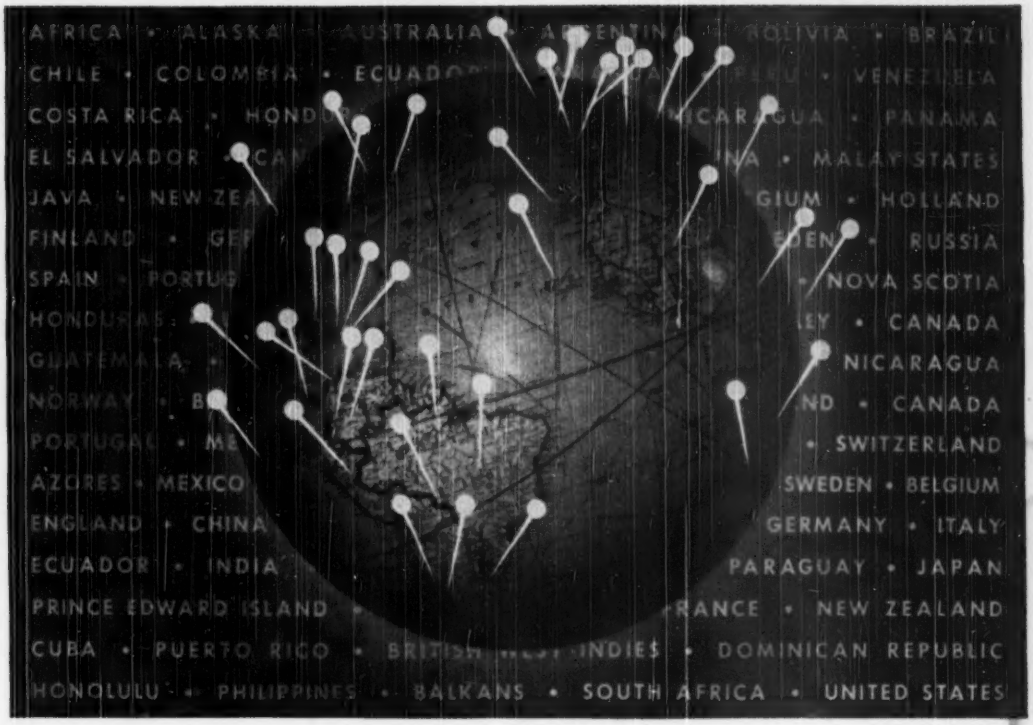
Copperweld® Chain Link Fence is the protective fence that protects itself. It *never* needs a drop of paint—no maintenance costs to worry about. There's no other fence like it. It is made of Copperweld Wire—with a thick, durable copper covering inseparably "Molten-Welded" to a strong steel core.

Because of its unique construction, Copperweld Fence is rust-proof, corrosion-proof. It provides long lasting property protection regardless of atmospheric conditions. It stays strong and in alignment. It costs less because it lasts longer.

Write today for a sample of Copperweld Fence and a copy of our new catalog—free on request.

*Trade Mark

COPPERWELD STEEL COMPANY
1025 Monongahela Ave., Glassport, Pa.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AZORES • MEXICO • SWEDEN • BELGIUM
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Over 10 million horsepower

serving throughout the world

The pins in this globe indicate more than fifty countries (not just installations) where Baldwin hydraulic turbines are used. It pictures the background of experience resulting from a century devoted exclusively to the design and manufacture of this type of equipment. It suggests one of the reasons why Baldwin turbines aggregating more than 10 million horsepower capacity have been installed or are on order.

Out of this wealth of experience Baldwin can recommend and build turbines of all types to fit the requirements of your power project. Sizes range from small fractional horsepower wheels up to the largest units that can be shipped.

Bulletin 252 will give you a quick picture of recent important Baldwin installations. Ask for it.

BALDWIN

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The Baldwin Locomotive Works, Philadelphia 42, Pa., The Pelton Water Wheel Co., 2929 Nineteenth St., San Francisco, Cal., U.S.A. Offices: Chicago, Cleveland, Houston, New York, Philadelphia, Pittsburgh, San Francisco, St. Louis, Washington.

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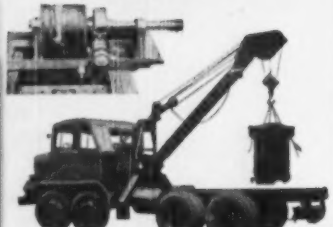
KRANE KAR Swing Boom Mobile Crane: for materials handling . . . lifting, transporting, positioning, gasoline or Diesel, 1½, 2½, 3 and 10 ton capacities, 9 to 37 ft. booms (or telescopic booms), solid or pneumatic tires. Self-stabilizing without jacks or outriggers; unobstructed vision; fast, flexible, safe, easy to operate.



WINCHES: Capstans; Single and Double Drum, Jaw Clutch, Keyed and Friction Clutch Winches. 2,000 to 50,000 lb. Capacities.

SWING BOOM CRANES: Truck; Motor Power Operated; high capacity; takes up only a small space. For handling transformers, cable reels, lamp posts, trees, poles, manhole castings, etc. 9 to 31 ft. booms; one to 10 ton capacities.

TOWERS: 2 or 3 section type and Pantograph types, with plain, revolving or racking platforms.

TRIPOD POLE DERRICKS: for 35 ft., 45 ft., and 60 ft. Poles; single piece or telescopic side legs; removable cast steel fittings.

USERS: AT&T; N. Y. Tel. Co.; T.V.A.; Consolidated Edison Co.; W.U.; Municipalities throughout America.

WRITE FOR CATALOGS:
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THE ORIGINAL SWING BOOM MOBILE CRANE WITH FRONT-WHEEL DRIVE AND REAR-WHEEL STEER
½, 2, 3 AND 10 TON CAPACITIES
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NEW ELECTRICAL CONSTRUCTION

NEW ELECTRICAL construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included

UTILITIES

Proposed Construction

Colorado—Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, Colo., three-phase power transformer for Pole Hill and Flatiron Power Plants, Colorado-Big Thompson, Spec. 3106.

Fla., Lake Worth—City, furnishing installing two 2500 kw diesel-electric generators complete with auxiliaries power plant. Plans deposit $10. Smith & Gillespie, P. O. Box 1048, Jacksonville, Zone 1, engrs.

Minn., Moorhead—City, P. A. Cook, clk., furnish and install lignite handling sys. in power plant, $150,000. R. D. Thomas & Associates, 400 Metropolitan Life Bldg., Minneapolis, engrs.

Mo., St. Louis—St. Louis-San Francisco Railway Co., E. L. Anderson, asst. ch. engr., 823 St. Louis St., Springfield, install communication sys. in Lindenwood Yard, 65 ft. steel communications tower, five 100 ft. steel towers for floodlighting sys. etc. 40 ft. flood light tower atop yardmaster's roof.

Nebraska—Dawson County PP Dist., Lexington, constr. 130.25 mi. rural distr. lines, Lincoln Co., $140,000. Raymond H. Reed & Co., Columbus engrs.

N. J., Vineland—Boro, Vineland, electric power plant addns., alterations, Approx. **$250,000**. Gilbert Assocs., Inc., 412 Washington St., Reading, Pa., consult. engr.

N. Y., Long Island City—Bd. Transportation, 250 Hudson St., New York, N. Y., 60th St. Tunnel conn. to IND Div., Rt. 125 A, Sec. 1 and 2. **$10,000,000.**

Oregon—U. S. Eng., Pittock Block, Portland, design, manufacture & delivery of 20,000 kva ac. generator for Big Cliff dam powerhouse on north Sanitam River.

Oregon—Bonneville Power Admin., 827 N. E. Oregon St., Portland, constr. Clatskanie sub'station Inv. 5270. Plans deposit $25. L. C. Stewart, 827 N. E. Oregon St., Portland, engr.

Oregon—Bonneville Power Admin., 827 N. E. Oregon St., Portland, Installing static capacitor at Mapleton substation. Inv. 5273. Plans deposit $25. L. C. Stewart, 827 N. E. Oregon St., Portland, engr.

South Dakota—Bureau Reclamation, Dpt. Interior, Hot Springs, construct Angostura Power Plant, Angostura Unit, Missouri River Basin Proj., Cheyenne Div. Spec. 3131.

Texas—Nueces Electric Co-operative, Robstown, 200 mi. rural distr. lines, 74 mi. conversion to 2 and 3 phase lines, converting 12,500 volt lines to 24,000 volt, Nueces Co., **$3,000,000**; 338 mi. rural distr. lines 133 mi. line rebuilding, Kleberg, Kenedy, Jim Wells, Live Oak, Duval, Nueces and McMullen Counties, **$640,000.** Freese & Nichols, 407 Danciger Bldg., Fort Worth, consult. engrs.

Texas—Erath Co. Electric Co-operative Assoc., George L. Martin, pres., 141.9 mi. rural distr. lines and conversion of approx. 29.3 mi. existing rural distr. lines, Stephenville, Erath, Palo Pinto, Young & Stephens Counties, (Tex. 69 VX Erath, Sec. 3), $160,000. Plans deposit $10. Freese & Nichols, 407 Danciger Bldg., Ft. Worth, engrs.

Texas—Nueces Co. Electric Co-operative Inc., W. F. L. Lehman, pres., Robstown, approx. 222.95 mi. new rural distr. lines and conversion of approx. 142.41 mi. existing rural distr. lines, Nueces, Kleberg, Kenedy, Jim Wells, Duval, Live Oak and McMullen Counties (Tex. 88N Nueces), $375,000. Plans deposit $10. Freese & Nichols, 407 Danciger Bldg., Ft. Worth, engrs.

Texas—Brazos River Transmission Electric Co-operative, Waco 2 story, 46x90 ft., headquarters facilities, maintenance and storage bldg., etc. $100,000. Harris, Harris & Roberts, 1105 Medical Arts Bldg., Waco, engrs.

Va., Charlottesville—office of Colcate W. Darden, Jr. pres., University of Virginia, Charlottesville, constr. power plant.

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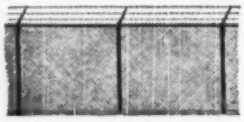

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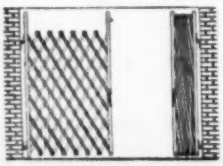

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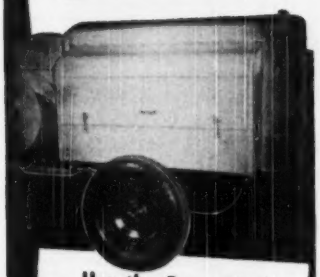

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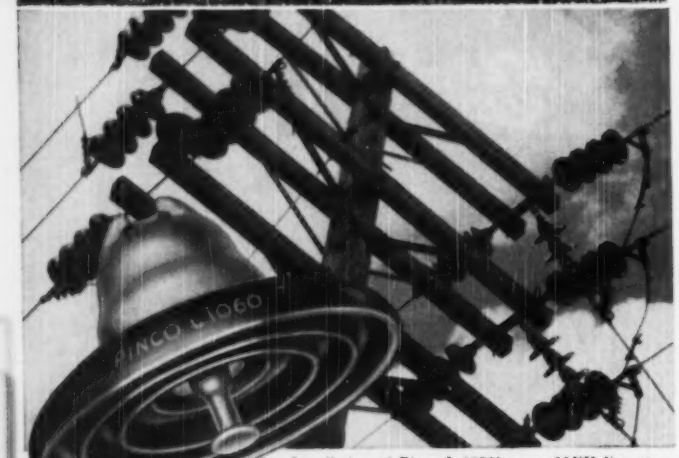

Installation of Pinco L 1070's on a 33KV line at Valatie, N. Y. Prize winning photo submitted by Robert S. Halligan, New York Power & Light Corp., Albany, N. Y.

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incl. coal and ash handling equip. and chimney, $300,000. Wiley & Wilson, 905 Peoples Bank Bldg., Lynchburg, consult. engrs.

Washington—Bonneville Power Admin. 827 N. E. Oregon St., Portland, Ore., constr. Snohomish substation, Coulee No. 2 terminal, Snohomish Co., Inv. 5268. Plans deposit $25. L. C. Steward, 827 N. E. Oregon St., Portland, Ore. engr.

Wash., Richland—General Electric Co., operator of Richland and Hanford Works for Atomic Energy Comn., Richland, radio communication system.

Wash., Seattle—Civil Aeronautics Admin., Anchorage, Alaska, airport surveillance radar transmitter-receiver facility underground duct sys. from Seattle-Tacoma airport to radar site.

Wyoming—Wheatland Rural Electric Ass'n., Wheatland, constr. 183 mi. rural distr. lines in Platte, Albany and Laramie Counties, $200,000. J. A. Cole, c/o owner, Wheatland, envr.

Low Bidders & Contracts Awarded

Colo., Trinidad—City, City Hall, July 20, gas transmission line from Delhi to Trinidad, from Martin Constr. Co., Ulysses, Kans., $92,040; rebuilding distr. line within city, from Warner Brothers Constr. Co., Inc., 2826 Eaton St., Denver, $186,031. Rocky Mountain Eng. Co., 1441 Welton St., Denver, archt. and engrs.

Minnesota—Carlton County Co-operative Power Assn., Kettle River, July 21, 152 mi. rural distr. lines, Carlton Co., from C.A. Hooper Co., 453 W. Gilman St., Madison, Wisc., $242,503.

Missouri—Sho-Me Power Corp., Mansfield, 66 mi. rural distr. lines, to Franklin Electric Co., Franklin, Ind., $377,733.

Mont., Billings—K O O K Broadcasting Co., Billings, four steel tower radio station, to Riedesel Constr. Co., Billings, $133,500.

New York—U. S. Eng., 80 Lafayette St., New York, Zone 13, July 26, installing lock operation machinery and electrical equip. and other misc work for electrification of Troy Lock, CIVENG 30-075-50130, from C. F. Wolfe, 2502 88 St., Glendale, N. Y., $183,510. Est. $195,948.

North Dakota—Bureau Reclamation, Dpt. Interior, Bismarck, Garrison-Voltaire, Devils Lake-Dakota and Jamestown-Valley City 115 kilovolt transmission lines, Transmission Div., Missouri River Basin Proj., Spec. 3032, to Orlando Constr. Co., Coleman, Wis., $752,500. Est. $795,580. Bids 6/23, awarded 7/24.

South Carolina—York County Electric Co-operative, York, July 19, 217 mi. rural distr. lines and 67.43 mi. conversion in York, Chester and Lancaster Counties from Little Electric Co., Hartsville, $246,489.

Wash., Spokane—Radio Station K H Q, Radio Central Bldg., 826 ft. broadcasting tower, to international Derrick & Equipment Co., 2410 Carson St., Torrance, Calif., $93,253.

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Calif., Los Angeles—Bd. Supervs., Los Angeles Co., 501 Hall of Records, Los Angeles, 12 story, steel frame superior courts. Approx. $11,000,000. Kistner, Curtis & Wright, 816 W. 5 St., archts.

Ill., Chicago—National Biscuit Co., 75 and Kedzie Sts., Zone 29, 2 story high, 700x1137 ft., 800,000 sq. ft., steel, brick, concrete bakery and flour storage plant, 135 ft. high storage bins, $12,000,000. Alexander D. Crosett, 27 Williams St., New York, N. Y., archt. and Everett Quinn, 134 N. La Salle St., Chicago, assoc. archt.

Low Bidders & Contracts Awarded

Ky., Brandenburg—Mathieson Chemical Corp., Whiteker Bldg., Baltimore, Md., design and construct plant for conversion of natural gas by products to hydrocarbon chemicals, to E. B. Badger & Sons Co., 75 Pitts St., Boston, Mass and Stone & Webster Engr. Corp., 90 Broadway, New York, N. Y. Total est. cost $13,000,000.

N. C., Acme—Riegel Paper Corp., c/o J. E. Sirrine Co., engrs., 215 S. Main St., Greenville, S. C., paper pulp plant, to C. M. Guest & Sons, Greensboro. Est. $13,500,000.

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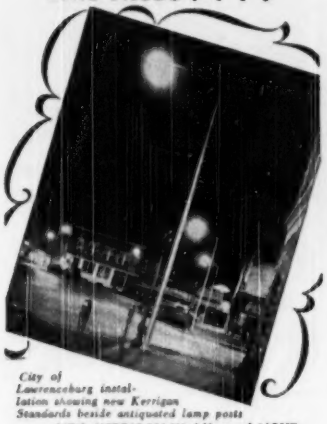

City of Lawrenceburg installation showing new Kerrigan Standards beside antiquated lamp posts

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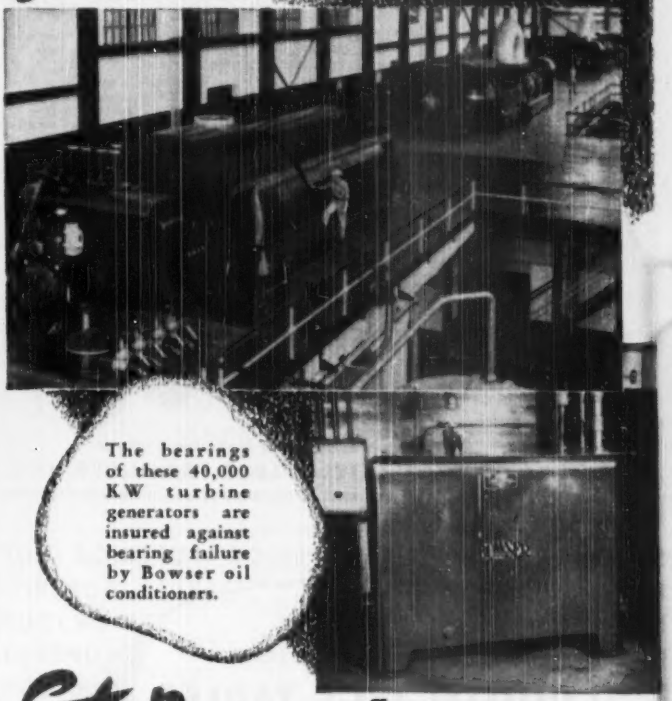

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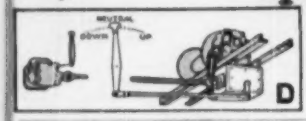

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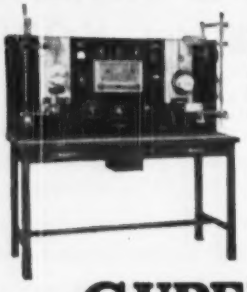

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TECHNICAL LITERATURE

Air Circuit Breakers—*NEMA Standards for Small Air Circuit Breakers* are furnished for rating, manufacture, testing, and performance of breakers up to 600 v ac or 250 v dc, 100-amp rating, 1,000 amp interrupting capacity. Publication AB1-1950 may be obtained at $1.10 from National Electrical Manufacturers Assoc, 155 E. 44th St, New York 17, N. Y.

Pole Life Extension—Re-impregnation of distribution line poles is economically desirable according to *Financial Survey of Transmission and Distribution Pole Costs and Economic Analysis of the Cobra Process.* The 24-page booklet has computations of pole depreciation, discussion of replacement costs, and calculations on service life probability. The brochure is published by Cobra Wood Treatment Corp, 124 E. 40th St, New York 16, N. Y.

Tubing and Sleeving—Testing, performance, and manufacturing qualifications are contained in *Standards for Varnished Tubing and Saturated Sleeving.* A table lists identification of grades, and a summary of performance characteristics is appended. Publication VSI-1950, at 50¢, is issued by National Electrical Manufacturers Assoc, 155 E. 44th St, New York 17 N. Y.

Glass Yarn—Publication GF2-1950, *Standards for Staple-Filament Glass Yarns,* is available for wire and cable-covering and electrical insulating materials. Yarn composition, physical properties, organic content, and nomenclature are listed. The 8-page booklet, price 70¢, is obtainable from National Electrical Manufacturers Assoc, 155 E. 44th St, New York 17, N. Y.

Titanium Alloys—Characteristics of aluminum-chromium-carbon-titanium alloys are reported in PB 100,000, *The Manufacture of Titanium Alloys.* The alloys are described as strong, ductile, and of high electrical resistance. Tables are included showing effect of varied constituents in titanium alloys. This 108-page bulletin is available at $4.50 in microfilm, $13.75 in photostat, from Library of Congress, Photo Duplication Service, Publication Board Project, Washington 25, D. C.

Laminar Theory—*A Laminar Theory of the Flow Through a Turbo-Machine* is Bulletin 62 issued by RPI. The report examines flow behavior of incompressible "ideal" fluids and also suggests a method for examining compressible fluids. Motion along the whirl, meridional motion, and flow characteristics are reated, as well as general theoretical considerations. An actual case is studied. The 44-page booklet is obtainable from Rensselaer Polytechnic Institute, Troy, N. Y.

Acoustical Measurements—Three publications list new standards for calibration of earphones and microphones: Z24.9-1949, *Coupler Calibration of Earphones,* 75¢; Z24.4-1949, *Pressure Calibration of Laboratory Standard Pressure Microphones,* 75¢; and Z24.8-1949, *Laboratory Standard Pressure Microphones,* 50¢. Z24.4-1949 replaces Z24.4-1938, while the others are new issues. The standards may be ordered from American Standards Assoc, Inc, 70 E. 45th St, New York 17, N. Y.

Lighting Practice—Principles to provide for good lighting in building design are set forth in *Recommended Practice of Daylighting.* The report recommends window arrangements, treatment of reflecting surfaces, and types of blinds and glass block. Criteria for adequate lighting are set up. This 36-page booklet can be purchased for 50¢ from Illuminating Engineering Society, 51 Madison Ave, New York 10, N. Y.

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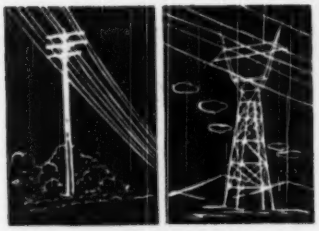

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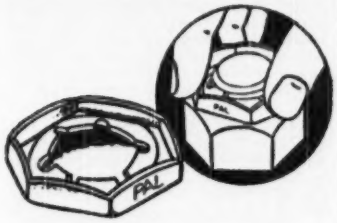

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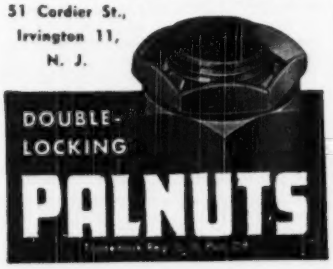

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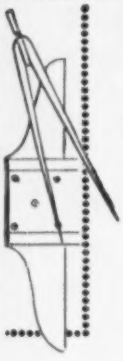

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These trailers are representative of the wide line offered by FWD-Eagle — equipment engineered by and for utility men expressly for their needs.

EAGLE MANUFACTURING CO.

Division of the Four Wheel Drive Auto Co.

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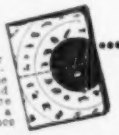
Write today for the complete catalog of FWD Line Construction and Maintenance Equipment — a useful reference book.



CATALOGS • BULLETINS

● TRANSFORMERS: Design and construction features of power and distribution transformers—large and small, and secondary network—are described in Bulletin 01B6186B. Also covered are the three types of load-ratio-control mechanisms available on the transformers. Allis-Chalmers Mfg Co, 932 S. 70th St, Milwaukee, Wis.

● SLUDGE REACTORS: "Sludge Contact Reactors" (Publication 5001) includes information on operation of reactors, types, correct design, applications, etc. Cochrane Corp, Philadelphia 32, Pa.

● SAFETY EQUIPMENT: The 1950 issue of "Everything in Safety" covers personal protective equipment and industrial safety devices for utilities, industry, and mines. General Scientific Equipment Co, 27th & Huntingdon St, Philadelphia 32, Pa.

● SURFACE CONDENSERS: Bulletin W-200-B1 has chapters on the company's surface condenser design, installation and construction methods, and auxiliary equipment such as circulating pumps and thermostatic controls. Worthington Pump and Machinery Corp, Harrison, N. J.

● LIGHTING: A complete listing of the new Lite-Blox line of recessed troffers along with complete descriptions appear in Form 869-8-50. The Edwin F. Guth Co, 2615 Washington Blvd, St. Louis 3, Mo.

● STREET LIGHTING BRACKETS: Different types of street lighting brackets and mast arms appearing in "Street Lighting Brackets" illustrate the variety that can be supplied to meet customer specifications. T. J. Cope, Inc, 711 S. 50th St, Philadelphia 43, Pa.

● STEAM HOOK-UPS: The sixth edition of "Steam Hook-Ups" pertains to steam traps, air vents, and industrial temperature controls. Copies are gratis to maintenance engineers writing on company letterhead. Sarco Co, Inc, Empire State Bldg.

● FIXTURES: The 1950-51 Fluorescent Fixture Catalog has illumination design data and illustrates more than 30 pages of fixtures with specifications. Leader Electric Co, 3500 N. Kedzie Ave, Chicago 18, Ill.

● TIMING DEVICES: Eight-page Catalog 323 describes the company's line of electrical timing devices. Haydon Mfg Co, Inc, Torrington, Conn.

● WELDING: Arc welding accessories, such as cable, ground clamps, and protective clothing are covered in "Welding Accessories". Data on seven Murex mild steel arc welding electrodes appear in "Mild Steel Electrodes." Metal & Thermit Corp, 100 E. 42nd St, New York 17, N. Y.

● MOTORS: One to 75-hp polyphase horizontal motors are described in Bulle-

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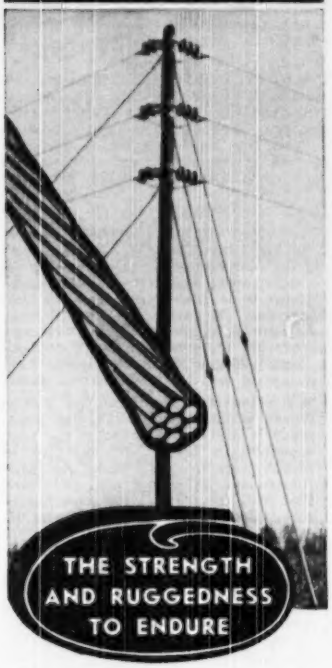
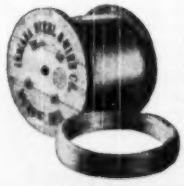
GALVANIZED STEEL
STRAND



STRENGTH to support the pole structure under maximum ice and wind loading . . . RUGGEDNESS to withstand the punishment incurred in construction and service . . . DURABILITY that outlasts the normal expectant life of the line . . . are combined—with important ECONOMY — in *Crapo* Galvanized Steel Strand.

Each size and grade develops the full tensile strength of the steel in cross section. The heavy, ductile, tightly-bonded zinc coating—applied by the famous *Crapo* Galvanizing Process—provides dependable protection for the steel.



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There is a size and grade of *Crapo* Galvanized Steel Strand for every practical need. Consult the distributor of *Crapo* Galvanized Products near you or write direct for further information!

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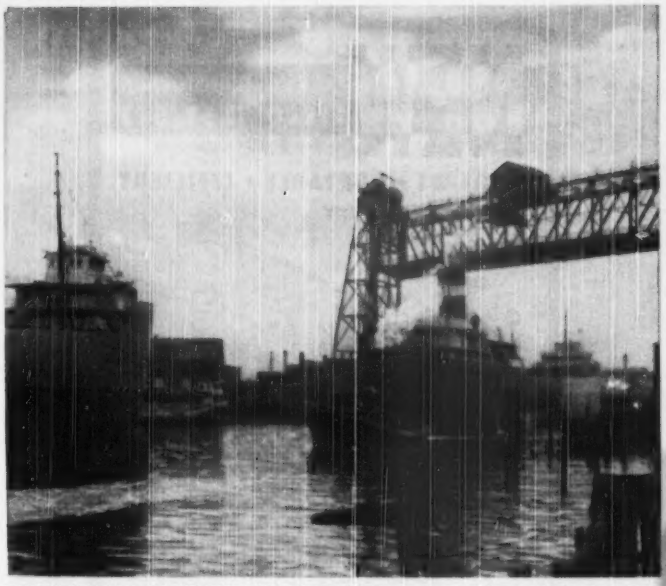


170-TON VERTICAL LIFT BRIDGE at Buffalo, N. Y., has control wiring safely insulated and sealed against moisture with "SCOTCH" No. 33 Electrical Tape.

Plastic tape saves $350 on Buffalo bridge wiring

Problem: how to stop circuit leaks on the $350 feeders of a vertical lift bridge control system. *Solution:* Buffalo, N. Y., engineer applies "SCOTCH" No. 33 Electrical Tape.

W. R. Green, Buffalo, N. Y., Engineering Dept., writes—"To avoid replacing the 4100 volt feeders, we insulated them with varnished cambric, Glyptol varnish, rubber and friction tape. This application lasted only about a month. Then we heard about "SCOTCH" No. 33 Electrical Tape. This tape has shown absolute evidence of accomplishing the work—even in snow and ice."

You can solve *your* insulating problem with one of the many "SCOTCH" Electrical Tapes. See your jobber, or write Dept. EW-850 today.

LEADS from pothead to oil switch sealed from humid, contaminated river atmosphere with plastic backed "SCOTCH" No. 33 Electrical Tape.

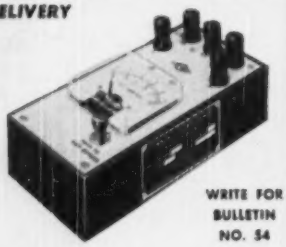
Made in U.S.A. by MINNESOTA MINING & MFG. CO., St. Paul 6, Minn., also makers of other "Scotch" Brand Pressure-Sensitive Tapes, "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-Slip Surfacing, "3M" Abrasives, "3M" Adhesives. General Export: Durex Abrasives Corp., New Rochelle, N. Y. In Canada: Canadian Durex Abrasives Ltd., Brantford, Ontario.

NEW CURRENT TRANSFORMER FIELD TEST SET

LIGHT WT • PORTABLE • EFFICIENT

IMMEDIATE DELIVERY

FOR ONLY $40 NET



WRITE FOR BULLETIN NO. 54

This NEW FIELD TEST SET quickly checks current transformer installations for — SHORT CIRCUITED TURNS, HIGH RESISTANCE JOINTS OR CONNECTIONS and GROUNDING. Test is made without interrupting service. Meter has four current ranges — 1.25-2.5-5-10 amperes.

Dimensions 7¼" x 3⅞" x 3⅛". Wt. 2 lbs. Set housed in a non-conducting molded plastic case.

EASTERN SPECIALTY CO.

3621 North 8th Street, Philadelphia 40, Penna.

HERE'S Half a Ton of Pull — TOOL-BELT SIZE!

The New 1000-lb. Mighty Midget Puller

ONLY $27.50
($19.75 for 500-lb. Model)

Combining easy portability with added pulling power, the new Coffing Mighty Midget does *more* jobs, does them *easier*. Only 9½ lbs. in weight, it hangs easily on a lineman's tool belt. Full half-ton capacity gives it plenty of power for stretching long spans of wire, raising heavy equipment, tightening guys — many other pulling and lifting jobs. Convenient 2-way handle serves as a lever or high speed crank.

Equip your crews with these new, stronger mighty midgets. See how their added strength and tool-belt portability speed maintenance and new construction. Write for Bulletin EMP8.

COFFING HOIST CO.

Quik-Lift Electric Hoists • Hoist-Alls • Safety-Pull Ratchet Lever Hoists • Spur-Geared Hoists • Differential Chain Hoists • Load Binders • I-Beam Trolleys

DANVILLE, ILLINOIS

tin EM4-812. A. O. Smith Corp, Motor Div, Los Angeles 22, Cal.

● INSULATORS, HARDWARE: Low voltage and high voltage insulators as well as line hardware needed for standard jobs are listed in 32-page Catalog No. 4. Included are M.P.L. aluminum strain and suspension clamps. There is engineering data, comparative insulator tables, and two indexes. Victor Insulators, Inc, 70 Maple St, Victor, N. Y.

● STREET LIGHTING: Eight new bulletins on street lighting equipment are available: Bulletins SL1 to SL5 describe various lighting fixtures; SS1 lists spare parts; SA1, brackets and mast arms; and SCE1, relays, transformers, ballasts, and switches. Line Material Co, Milwaukee 1, Wis.

● DEWATERING: Profusely illustrated 64-page "Moretrench Wellpoint System" gives a picture history of predraining operations using wellpoint equipment. Emphasis is on power plant and dam construction. Second part gives characteristics and specifications of different pumps, wellpoint and pipe fittings. Moretrench Corp, Rockaway, N. J.

● BEARINGS: "Installation, Maintenance, Removal of Anti-Friction Bearings" is said to be probably the most comprehensive booklet on the subject of bearing care to date. There are many illustrations on proper shop procedure. The Anti-Friction Bearing Distributors' Assoc, 1900 Euclid Bldg, Cleveland 15, Ohio.

● LUMINAIRES: No. L50 "Handy Reference Condensed Lighting Guide" covers fluorescent and slimline ceiling luminaires and incandescent down lights, spots, etc. Garden City Plating & Mfg Co, 1750 N. Ashland Ave, Chicago 22, Ill.

● FURNACES: The complete line of sintering furnaces (all but one for continuous operation) is included in Bulletin 230; also information on proper atmosphere generators. Public Relations Div, Lindberg Engineering Co, 2444 W. Hubbard St, Chicago 12, Ill.

● RUST PREVENTION: A vapor method of rust prevention which can be applied to a number of electrical parts is discussed in considerable detail in "Angier VPI Wrap". Angier Corp, Framingham, Mass.

● THERMOMETER: Recording thermometers, as well as liquid-filled, vapor pressure, and gas-filled types, are described in Bulletin TS40 models for indicating, controlling, and telemetering of temperatures. The Bristol Co, Waterbury 20, Conn.

● MAGNET WIRE: Complete information on Formex and Deltabeston magnet wires is available in a 32-page booklet, No. 19-329. General Electric Co, Construction Materials Dept, Bridgeport 2, Conn.

● DC MOTORS: Dc motors made by the company are depicted in 4-page Bulletin B.39-200. The Electric Products Co, 1725 Clarkstone Rd, Cleveland 12, Ohio.

E-M Service Masts are the perfect support for service wires on ranch type houses and low commercial structures that do not provide sufficient ground clearance to comply with National Electrical Code requirements (2322 a. & b. 1947).

E-M Service Masts are neat rugged units that require no guy wires. They look good, are hot galvanized to last a lifetime. Developed in cooperation with utility engineers and electrical contractors.

WRITE FOR BULLETIN 51

Electrical Manufacturing Co.

Pole Line Hardware

154 Angell St., BATTLE CREEK, MICH.

At left—Sherman "Wedge-Grip" Connector, with *extra* reinforcing thread plate.

At right — Sherman Split Bolt, strongest connector of its type made today.

An Invitation—

To Utility Executives

We sincerely believe that Sherman Solderless Connectors make today's strongest, most permanent, most economical service entrance connections.

However, you don't have to take our word for it. We invite you to make your own tests and draw your own conclusions. For that purpose we will gladly send you samples of Sherman Split Bolts and Wedge-Grips, without cost or obligation.

Write us today. We predict you'll be agreeably surprised both by the quality and the low price of Sherman Connectors.

H. B. SHERMAN MFG. CO.

BATTLE CREEK, MICHIGAN

Sherman

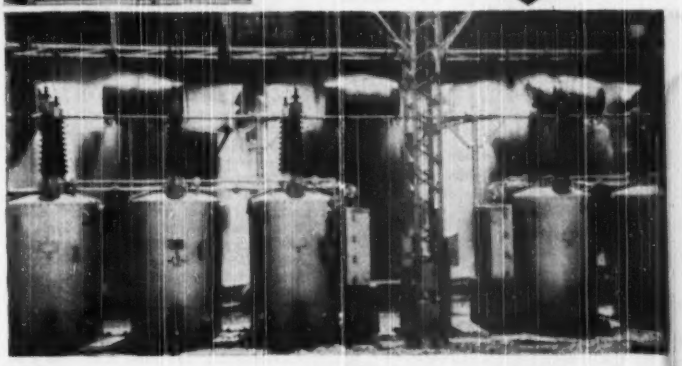
SOLDERLESS SERVICE CONNECTORS

MULSIFYRE

now on guard to kill oil fires fast

This transformer fire did $50,000 damage at an electric power station.

Transformers at this electric power station are now safeguarded by a Grinnell Mulsifyre installation. Fast, automatic spray action is being demonstrated here.



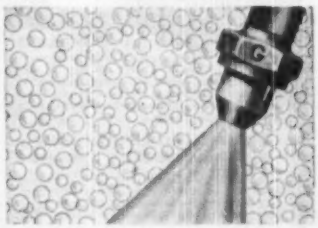
When an oil fire breaks out in transformers protected by a Mulsifyre system, a battery of spray projectors puts out the fire . . . fast. Automatic, heat-actuated release devices assure quick operation. Extinguishment occurs within a few seconds after the emulsion-forming spray strikes the surface of the burning oil.

Mulsifyre projectors are approved by Underwriters' Laboratories, Inc. for extinguishing fires in flammable oils immiscible with water. There is no conductivity along the discharge of a Mulsifyre projector when the spray strikes conductors carrying high voltages.

Mulsifyre high-velocity projectors produce drops large enough and drive them fast enough to penetrate the flames without complete vaporization in flight, but limit their velocity so the surface of the burning liquid is agitated into an emulsion instead of passing through the oil without fire-extinguishing effect. After a period of time, the emulsion breaks down, oil and water separate, and the oil can be reclaimed.

Mulsifyre systems have proven their effectiveness during sixteen years of extinguishing transformer fires. Today they protect hundreds of installations all over the world.

For information on Mulsifyre systems or other Grinnell Fire Protection Systems write Grinnell Company, Inc., Providence, R. I. Offices in principal cities.



GRINNELL *Mulsifyre*

EMULSION-EXTINGUISHMENT OF OIL FIRES

FIRELESS LOCOMOTIVES

may be the best answer to your yard haulage and switching problems. The Vulcan fireless locomotive shown above saves fuel at a modern central station because the storage tank is charged with low-cost steam from the stationary boilers. Labor Costs are low because only one operator is required and any one can quickly master its simple controls. Maintenance Costs are low because there is no firebox or boiler and all working parts are very strong and durable.

Simple, powerful, smokeless and practically noiseless. Vulcan fireless locomotives are backed by a hundred years of successful experience, during which nearly 5000 steam locomotives have been built and delivered throughout the world.

Write us regarding your track-haulage requirements. We also build Diesel locomotives and our experienced engineers welcome opportunities to make unbiased recommendations without charge or obligation.

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A DEPENDABLE SUPPLY — General Ceramics offers a reliable supply of uniformly high quality wet process porcelain electrical insulators. Competent engineering cooperation is always available to help work out your designs.

Available in Wet Process Porcelain or Steatite, Metallized if Needed

Use General Ceramics Wet Process Steatite for extra mechanical strength. Can be tapped without metal inserts. Also obtainable metallized to specification. ESTIMATES WITHOUT OBLIGATION.

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BOOK REVIEWS

The Integrated System. By Philip Sporn. Published by McGraw-Hill Book Co. New York 18. 157 pages, illustrated. Price $4

It is not necessary to understand electricity and electrical engineering to learn why the integrated power system is the basic mechanism for power supply to an area. Engineering intricacies are skillfully avoided by the author in explaining what is expected of an adequate and reliable system and how that objective is achieved. The technical foundation is established, the evolution toward integration, the tools of the system engineer, the importance of competent operators—all are tersely treated in showing how integration is conceived, how it emerges and how it performs its social and economic functions.

Circuits in Electrical Engineering. By C. R. Vail. Published by Prentice-Hall, Inc, New York 11. 560 pages, illustrated. Price $7.65.

There has been need for a book like this not only for students but for practising engineers confronted with circuit computations. Care has been taken by the author to begin at the beginning, namely the electronic structure of matter and the drift which constitutes amperes, and then emphasize every concept upon which progressive understanding is built. In fact one-fourth of the pages are devoted to the parameters before circuits are discussed at all. Ensuing chapters deal with basic circuits, networks, coupling, polyphase and finally with non-sinusoidals and transients. There is much explanatory subject matter worthy of reassuring reference when in doubt.

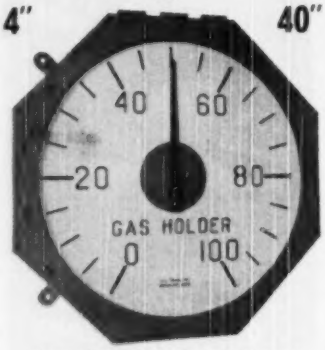
Electrical Who's Who. Published by Electrical Review Publications, Ltd, London (S.E.1). 204 pages. Price 12s 6d.

Names, present connections and condensed careers are given for some 2,400 personalities in the professional and industrial branches of the British electrical industry. Particularly helpful to an American unfamiliar with British alphabetics, 82 abbreviations are listed for the associations and honors with which the individuals are associated.

Practical Television Engineering. By Scott Helt. Published by Murray Hill Books, Inc, New York 16, N. Y. 708 pages, illustrated. Price $7.50.

In no sense a service manual this book by a DuMont research engineer records for the practising engineer the technology as presented in his course at Columbia. It begins with the principles of light and of the cathode-ray tube and oscillograph and the evolution into the iconoscope and image orthicon. There follows a discussion of synchronization, video amplifier and cathode follower, the circuits of the transmitters and receivers. For the engineers and commercial department staffs of power companies there is ample treatment of the variation in television reception with the possible variations in characteristics of the voltage, frequency and wave-form of the power supplied to transmitter and receiver. How effective the inbuilt voltage regulation can be despite input voltage fluctuation and output loading is the theme of one chapter devoted to the degenerative voltage-regulating circuit. This value is, of course, incidental to the comprehensive and lucid electronics discussion of the whole art of television and its tooling.

TRANSMITTERS AND INDICATORS
TO
4" 40"



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- Turbine Order
- Load Indicating
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- Valve Position
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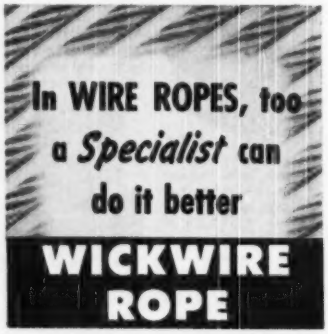
Special Designs Our Specialty
SIG-TRANS, INC.
AMESBURY, MASS.



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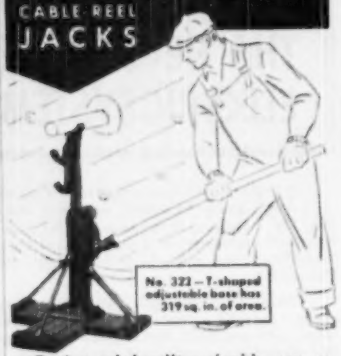

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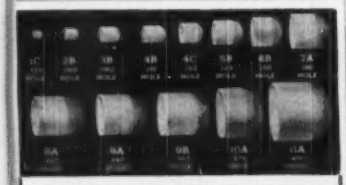

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TOOLS

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See your supply house or write direct for details, prices, etc.

H. K. PORTER, Inc.
Somerville 43, Mass.

Oil Life Measured

(Continued from page 75)

characteristics of various transformer oils. However, it is our belief that the method is a distinct improvement over prior tests devised for the same purpose.

Inasmuch as it has been correlated with a long term test of four years, it does easily supersede the very long duration test, and it definitely is superior to those test procedures which show results over a very short period ranging from only a few days to a few weeks.

Deterioration Indexes . . . Total acid number of oil samples as measured for this test is according to ASTM Test No D-664-44T.

"Percent Sludge" is determined by a method developed at this laboratory. It determines the sludging propensity of an oil, over a definite deterioration period, by measuring the percent sludge content of a selected portion of the whole sample under test.

A wide mouth glass weighing bottle at the bottom of the test cell is used to catch any deposited material precipitated during a specific deterioration period. The sample is captured by covering the bottle without disturbing the oil.

After a cleaning procedure, gravimetric analysis is made to determine the percent deposited material. This is designated as Percent Insoluble Sludge of Sample. It bears a relationship to percent insoluble sludge of the whole, and so provides a basis for calculating sludge rates that cannot be done by the scraping of surfaces method, since that is only a measure of the quantity of the sludge at the end of test.

Percent Soluble Sludge of the sample may be assumed to be of the same order of the percent soluble sludge of the whole and will need no additional calculation after applying simple gravimetric analysis of sludge precipitated by precipitation naptha.

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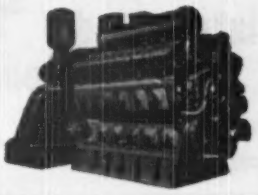

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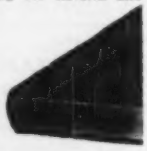

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LETTERS TO THE EDITOR

Wire Carrying Capacity

To the Editor of ELECTRICAL WORLD:

In regard to data on Engineering Reference Sheet No. 50-10, ELECTRICAL WORLD, May 8, 1950, I would like an explanation of why weatherproof wire has a greater ampere carrying capacity than bare wire of the same size. All reference books seem to disagree with the data that was published.

C. O. Moore
Line Foreman

Monongahela Power Co
Morgantown, W. Va.

IN REPLY . . . Of course, the only complete way for anyone to prove this to his own satisfaction is to check our calculations by the use of the formulas given in my article "Current-Carrying Capacity of Overhead Conductors", ELECTRICAL WORLD, May 15, 1943, pp 60-62. A general explanation can be given, however. An examination of those formulas will disclose that the amount of current a wire can carry under certain temperature conditions is dependent upon the amount of heat that can be dissipated from the surface of the wire; the less dissipation the lower the current. The amount of heat dissipation is roughly proportional to the amount of the surface area of the wire and the thermal emissivity of the surface. The temperature difference between the wire and its surroundings also has an effect on the current carrying capacity but the effect is not directly proportional to this difference in temperature.

Since the surface area of a weatherproof wire is considerably larger than the surface area of the same gage of bare wire, the amount of heat dissipated will naturally be greater on that account. The surface area of weatherproof wire is from 50% to 100% greater than the surface area of the same wire without the weatherproof covering. Also, the thermal emissivity of the braid is greater than the emissivity of the bare wire. As a result, the weatherproof wire could carry from 50% to 100% more current than the bare wire of the same gage if the surface of the braid were allowed to operate at the same temperature as a bare wire.

In our calculations we took the surface temperature of the weatherproof wire at 70 C whereas the temperature of the bare wires was taken at 80 C. This reduction in surface temperature cuts down the carrying capacity of the weatherproof wire somewhat, but since the effect of the greater surface area of the weatherproof wire is greater than the effect of the temperature reduction, there is still a margin left to permit the weatherproof wire to carry a greater current than the bare wire. In other words, the gain in capacity by increasing the surface area is greater than the loss in capacity by reduction of surface temperature.

Mr. Moore mentioned that carrying capacities given in reference books seem to disagree with the data given in my article. I think this can be explained by the fact that current carrying capacity information given in various reference books may have been calculated at different values of temperature and air velocity for weatherproof wire than for bare wire. Furthermore, most of those tables were calculated by older and less accurate formulas and possibly the same formulas were not used for weatherproof wire as for bare wire.

H. A. Enos
Chief Distribution Engineer

American Gas & Electric Service Corp.
New York, N. Y.

Simplified Electricity

To the Editor of ELECTRICAL WORLD:

On page 70 of your June 5, 1950 issue under the title, "Speaking Their Language," you refer to a publication called *Simplified Electricity for Utility Workers*, by P. R. Rutledge of the Central Hudson Gas & Electric Corp. Your description of this course makes me feel it may be just the publication I've been looking for to enable me to bridge my non-technical knowledge of the electric utility business with the engineers' production and distribution end. Will you kindly send me full particulars on Mr. Rutledge's work or give me his address that I may correspond directly with him to determine if the treatise is the instrument I'm endeavoring to find.

J. Franklin Smith
District Manager

Pennsylvania Electric Co

(Editor's note: Because several requests have been received, ELECTRICAL WORLD believes that other readers may want a copy of *Simplified Electricity for Utility Workers*. For your copy write to P. R. Rutledge, Central Hudson Gas & Electric Co, Poughkeepsie, New York.)

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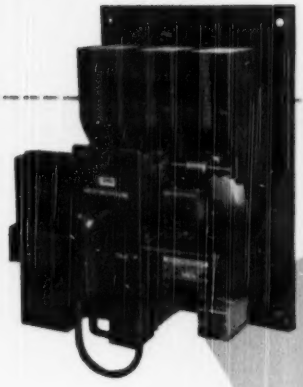

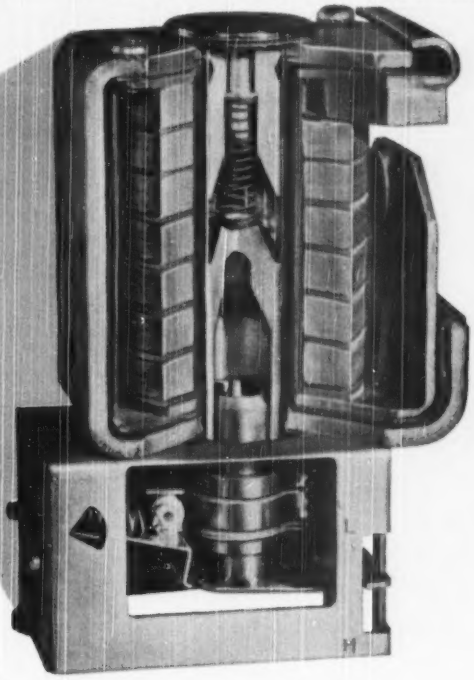

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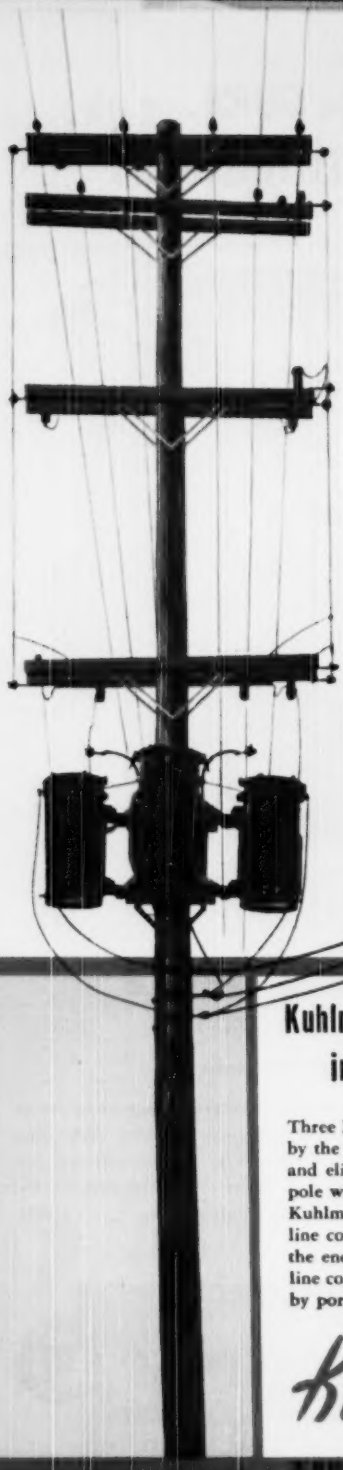

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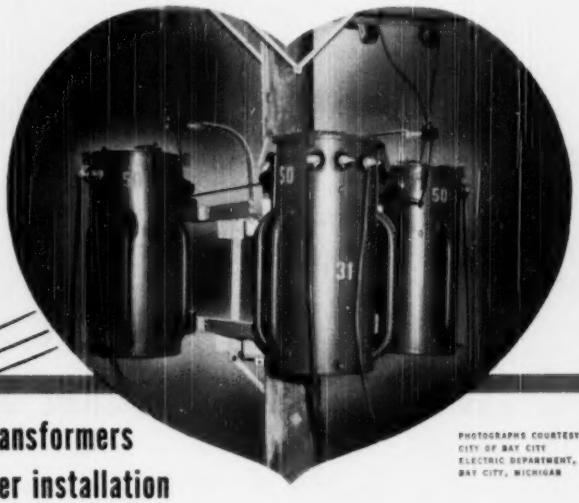

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Kuhlman Transformers in cluster installation

Three Kuhlman 50 KVA transformers are shown in this cluster installation first developed by the Detroit Edison Company. The type of mounting utilized keeps units close to pole and eliminates the usual heavy cantilever supports. It also provides balanced loading of pole with maximum accessibility to primary transformer terminals and top pole structure. Kuhlman clamp-type primary bushing terminals greatly ease and speed the job of making line connections in group installations like this. A quick twist of the porcelain knob on the end of the bushing opens or closes the clamping mechanism, freeing or securing the line connection. No tools are necessary and, since all metallic parts are entirely surrounded by porcelain, the safety factor is greatly increased.

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